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THE UNIVERSITY OF ALBERTA

THE DEVELOPMENT OF JAPANESE CONNECTIVES OF SEQUENCE AND SIMULTANEITY

by

MICHIKO KAWASHIMA

(C)

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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OF DOCTOR OF PHILOSOPHY

IN

PSYCHOLINGUISTICS

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(SIGNED) Michiko Kawashima

PERMANENT ADDRESS:

15428 - 76 A Avenue

Edmonton, Alberta

T5R 3A8

Date: April 17, 1987

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled THE DEVELOPMENT OF JAPANESE CONNECTIVES OF SEQUENCE AND SIMULTANEITY submitted by MICHIKO KAWASHIMA in partial fulfilment of the requirement for the degree of DOCTOR OF PHILOSOPHY in PSYCHOLINGUISTICS.

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Supervisor

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External Examiner

Date November 28, 1986.....

To Junichi, Jun and Ken

ABSTRACT

The present study was an attempt to clarify the question of what are the most relevant factors determining the development of Japanese temporal connectives.

Three hypotheses were formulated. Hypothesis 1 tested whether the developmental order of temporal notions can predict the development of Japanese temporal connectives. Hypothesis 2 tested the role of local cues as proposed in Slobin (1982), who argued that certain structures can function as local cues and facilitate the child's acquisition of language. The role of local cues was investigated to provide further evidence to clarify the process of language acquisition from cross-linguistic data. In the present study, the local cue under consideration is grammatical aspect expressed by the V-ru/-ta form in temporal clauses. Hypothesis 3 investigated the effects of task differences reported in the developmental literature of temporal connectives: a better comprehension of connectives in a meaningful condition than in an experimental condition.

The present study adopted two kinds of comprehension tasks: a story comprehension and an act-out task. Ninety-six children, equally divided into the three age groups of 3, 4, and 5 were examined. In addition, ten children each from grades 5 and 6 and ten adults participated in the experiments.

The results did not support Hypothesis 1. It was speculated that factors other than conceptual notions are operative in the acquisition of temporal clauses. Hypothesis 2 was supported by the results

of ato 'after' clauses, where the V-ta form serves as a local cue in ato clauses, but the V-ru from does not serve such a function in mae 'before' clauses. The results also demonstrated clear task differences. The story tasks generally seem to have succeeded in eliciting unbiased responses when compared with those of the act-out tasks. Thus, the results corroborated Hypothesis 3.

The results with grade 5 and 6 children have shown that older children still have problems with a complete understanding of the aspectual system. Aspect may facilitate the processing of sentences such as ato sentences. It was suggested that further studies are needed in order to determine under which conditions grammatical devices such as aspect act as local cues.

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1. INTRODUCTION

1.1 Preliminaries

The relationship between cognitive and linguistic development has long been discussed in the developmental psycholinguistic literature. Within semantic development, since the learning of a word amounts to the mapping of its meaning onto its sound, and since meanings are often supposed to be concepts, the development of concepts and their organization has had a significant influence in developmental linguistics (Carey, 1982).

The present study attempts to investigate the development of Japanese temporal connectives which relate sequential or simultaneous events. The proper use of those temporal connectives requires the child to understand the meaning of the words. The child should have acquired notions of temporal relations which he observes between events prior to learning of words. In other words, the order of appearance of the words should follow that of the relevant concepts in the cognitive domain.

Developmental studies of both sequential and simultaneous connectives are relatively few in number, especially when compared to those of before/after studies (Clancy et al., 1976; Feagans, 1980; Ferreiro, 1971; Kayra-Stuart, 1980; Keller-Cohen, 1975; Munro & Wales, 1982). In these studies, the development of concepts has often been discussed within the Piagetian framework. Although Piaget did not directly investigate the order of acquisition of sequence and simultaneity, he proposed that the notion of simultaneity was constructed from notions of sequence (1969). Other researchers maintain

that the sequential relations may be easier to grasp than the simultaneous relations since the child tends to attend to events one at a time (e.g., Ferreiro, 1971). Experimental studies also support a later development of simultaneous relations (e.g., Feagans, 1980; Keller-Cohen, 1975).

The sequential notions appear to develop quite early in the child's cognitive development. It is reported that the seriation of events independent of one's own actions is already well-organized late in the sensory-motor period (12-24 months) (Flavell, 1963). Based on these proposals, the emergence of notions of sequence are predicted to take place before those of simultaneity. But how about the notions of before/after? It has been suggested that production of before/after sentences only becomes possible when the child reaches the level of reversibility (around 7;0) (Ferreiro & Sinclair, 1971). The claim is that the child below the level of reversibility "regards the two events as two separate entities, neither of which constitutes a reference point for the other" (p. 45). Although the claim made by Ferreiro and Sinclair is questionable against the data reported in their study, conceptual knowledge underlying before/after sentences is considered to develop late. Consequently, cognitive development predicts the development of temporal notions in the order of sequence > simultaneity > sequential notions of before/after.

This order is well reflected in the acquisition of temporal connectives reported in the developmental psycholinguistic studies. Clancy, Johnson and Silva (1976) collected the acquisitional data of connectives recorded both in longitudinal observations and cross-sectional studies from four languages: English, Italian, German, and Turkish. The results indicated the emergence of sequential and

simultaneous connectives in a fairly uniform order of when, while > before/after across the four languages. Sentences which express the notions of sequence appear first in every language without any connectives initially. Clancy et al. did not include and sentences in their study. According to Bloom, Lahey, Hood, Lifter and Friess (1980), however, and is the first connective to appear and is used to express many semantic functions thereafter. And then is reported to follow and, and should be the first temporal connective to emerge.

In contrast to the study by Clancy et al., other experimental studies (Feagans, 1980; Keller-Cohen, 1975) found that simultaneous connectives developed later than sequential ones including before/after. These contrary results might be explained in terms of the experimental tasks employed. In the comprehension task reported in Feagans (1980) and Keller-Cohen (1975), the child was required to manipulate toys. Although it is claimed that care was taken for the child to handle the toys easily, it is naturally difficult to act out two events described in the sentence simultaneously within the experimental situation. The assessment of the child's linguistic development should be made in "more natural, familiar and ecologically valid situations," as Miller (1982) proposed for evaluation of cognitive performance.

As noted above, the study by Clancy et al. supported the prediction of a developmental order of connectives based on cognitive development. As to the time of appearance of connectives, however, there is a considerable disparity across languages. For example, the first appearance of before/after is earlier in Italian and Turkish than in English. Slobin (1982) also reported that Turkish children understood before/after sentences at a much younger age than English

children in the comprehension tests. It is not the case that the Turkish children are precocious and reach the level of reversibility faster. Slobin explains the results in terms of 'local cues', which operate on localized elements in sentences and signal underlying meaning. In Turkish, verbs are nominalized in the subordinate clauses of before/after sentences. Since the event referred to in the subordinate clause of before sentences has not occurred at the time of the main clause event, the verb form in the subordinate clause expresses potential, followed by a negative particle. In after clauses, on the other hand, the verb form indicates a realized action. Slobin suggests that the negative particle is a strong local cue. Once the child realizes in the comprehension task that he is required to act out two events, the cue functions to clarify the sequential relation. In fact, Slobin claims that the early development of Turkish before/after sentences calls in question the explanation of the acquisition of these terms which is based on the development of cognitive notions. The role of such factors as local cues should be investigated to clarify the process of language acquisition.

Japanese temporal clauses have 'local cues' in the sense defined by Slobin (1982). In Japanese, the verb -ru and -ta forms express aspect as well as tense. The -ta form denotes the past tense and the -ru refers to the events or states in the present and future. As to aspect, the -ta form signifies the completive aspect, and the -ru the incompletive aspect. The -ta is used in main clauses or in simple sentences when the event referred to occurred earlier than the speech time; otherwise, the -ru is used. In subordinate clauses, the use of these forms depends on the temporal relation of the event in the subordinate clause to that in the main clause; if the former is earlier

than the latter, the -ta is used and if later, the -ru is used (Ota, 1983; and Soga, 1983).

These aspectual characteristics of the -ru and -ta forms are exemplified in the temporal structures of mae 'before', and ato 'after'. The verbal phrases in the clause of mae should be in the V-ru form regardless of the tense of the main clause because the event in the mae clause follows that in the main clause. On the other hand, the verbs in the ato clauses should be in the V-ta form since the event in these clauses occurs prior to that in the main clauses.

These differential aspectual characteristics of the -ru and -ta forms affect the meaning of toki 'when' sentences, as well. Observe the following toki sentences taken from Soga (1983, p. 71):

(1) Kyonen Yokohama ni {iru / ita} toki Tanaka-san ni atta.
last year in is/was when Mr. Tanaka with met
"When (I) {(lit.) am / was} in Yokohama last year, I met Mr. Tanaka."

(2) Yokohama ni {iku / itta / go / went} toki Tanaka-san ni atta.
to
"When (I) {(lit.) go / went} to Yokohama, (I) met Mr. Tanaka."

In sentence (1) the stative verb iru 'to be' is used, while in (2) non-stative verb iku 'to go' is used. Soga states that the change of the -ru to -ta does not affect the meaning of sentence (1). It signifies the simultaneous event relations to the subordinate and main clauses since stative verbs specifically indicate incompletive, durative aspect regardless of the tense. In other words, both the -ru and the -ta forms express a durative state, in which the event in the main clause occurs. The replacement of -ru by -ta in the toki clause in sentence

(2), however, changes the meaning of that sentence. The -ru indicates that the event was incomplete at the time when the event in the main clause took place, resulting in the meaning, '(I) met Mr. Tanaka on my way to Yokohama.' On the other hand, the most natural interpretation for -ta in the toki clause is that the event in it precedes that in the main clause, that is, 'After (I) went to Yokohama, (I) met Mr. Tanaka.' The local cues in the subordinate clauses of Japanese temporal sentences may be not so strong as those in Turkish. Yet, they may be operative as processing cues, as the appearance of mae 'before' sentence has already been noted in the Japanese data of a 3-year-old (Kokuritsu Kokugo Kenkyujyo, 1981). The functions of local cues should be investigated in the acquisition of Japanese connectives.

1.2 Hypotheses

The present study attempts to investigate the development of Japanese temporal connectives expressing a sequential and a simultaneous relation. The following hypotheses are formulated to test the development of the connectives in experimental tasks.

Hypothesis 1: The developmental order of temporal connectives is isomorphic with that of the development/emergence of temporal notions.

Hypothesis 2: Local cues, the V-ru/-ta forms, in mae ni/ato 'before/after' clauses facilitate the development of these sentences.

Hypothesis 3: Comprehension of the temporal connectives is better in a natural, meaningful condition than in a experimental condition in which arbitrary sentences are used to test the temporal connectives.

Hypothesis 1 is formulated to test whether the developmental sequence of temporal connectives in the present study can be predicted by the developmental order of the corresponding notions. Hypothesis 2 is formulated to test the role of local cues in the acquisition of Japanese temporal connectives.

The experiment in the present study is conducted in both an experimental and a more natural, meaningful condition, and the results are compared to each other. Recent investigations of memory have revealed that preschoolers have knowledge about routine events or repeated familiar experiences, and that they utilize this knowledge when the verbal or situational context calls for it (e.g., McCartney & Nelson, 1981). In the present study, routine events about the daily life of a young child are employed to provide for a natural, meaningful condition in the story task. Children's responses regarding the temporal relation between events are compared to the second story task in which the event order is not as logical nor predictable as in the event series about daily life, and to two act-out tasks.

1.3 Overview

Chapter Two consists of a review of studies of cognitive development. In Chapter Three, Japanese temporal connectives are discussed, followed by a review of developmental studies of temporal connectives. The plan of the experiment is described in Chapter Four. The results of the experiments and discussion are found in Chapter Five. The results do not support Hypothesis 1, but confirm the function of a local cue stated in Hypothesis 2. The differential results of tasks corroborate Hypothesis 3. Chapter Six summarizes the main findings of the present study and suggests further studies to be carried out to clarify the development of Japanese temporal clauses.

2. COGNITIVE DEVELOPMENT OF TEMPORAL NOTIONS

2.1 Introduction

The relationship between language and cognitive development has long been debated in developmental psycholinguistics. An argument for a cognitive basis for language development seems particularly obvious in the acquisition of words because a concept is considered to constitute one component of meaning (Carey, 1982). The relation is not so clear in the areas of linguistic development such as syntactic acquisition. In general, the conceptual notions underlying language may possibly be formed by child's interaction with his surroundings quite independent of language. If so, the developmental order of linguistic forms, which are related to each other in meaning, should be predicted according to the developmental order of their corresponding notions in the cognitive domain regardless of the language, as Slobin (1973) suggested a decade ago. It has been pointed out, however, that various linguistic factors may also contribute to the development of a given linguistic form (Bloom, Lahey, Hood, Lifter & Fiess, 1980; Slobin, 1973). Even in word acquisition, a reciprocal function of language to create concepts is also noted (e.g. Markman & Hutchinson, 1984; Schlesinger, 1982). Consequently, it is important for us to investigate and clarify this developmental interface between conceptual knowledge and language.

This chapter is devoted to a review of studies in which the relation between cognitive and linguistic development is discussed with

particular emphasis on the acquisition of temporal notions. The chapter consists of two sections. The first briefly reviews studies which address the relation in general. In the second, the development of temporal notions is discussed, based on which the developmental order of temporal connectives is predicted.

2.2 Cognitive Development and Linguistic Development

The relationship between language and cognitive development is one of the most important issues in developmental psycholinguistics. In syntactic development, the earlier trend in research of a formal analysis of the child's initial linguistic development was shifted to a more semantically-oriented approach in the first half of the 1970s. Researchers, not content with describing the child's utterances without taking account of his intentions, tried to find out the child's intended meaning in the utterances and to incorporate them in their analyses (e.g., Greenfield & Smith, 1976; Schlesinger, 1971, 1974; Slobin, 1970). This new emphasis on semantic consideration in developmental linguistic research naturally necessitated that general cognitive and perceptual development be taken into consideration. Beyond the initial stage of syntactic development, however, the relation of cognitive development to the linguistic domain is hard to specify. There are not many studies carried out to directly investigate this relation (cf. Greenfield, Nelson & Saltzman, 1972; Greenfield & Schneider, 1977).

This issue is also raised in Slobin (1973) for syntactic development but with a different approach. Based upon Piagetian studies which claim the universality of the conceptual development (Miller, 1982; Morehand & Morehand, 1974), Slobin argued for cognitive primacy over linguistic development and for a uniform order of appearance of conceptual notions across languages. In fact, Slobin (1973) reported many instances to support his argument, in which the acquisition of some forty languages was investigated. For Slobin, cognitive complexity not only included the notions but also the forms themselves which express the notions. According to him, the time of appearance of a given notion should be constant across languages but it may well also depend upon the formal complexity which expresses the notion. While Slobin claims that complex forms must be cognitively harder for the child, he does not present independent evidence from the cognitive domain, as Atkinson (1982) points out. The formal complexity in Slobin's study is defined in terms of the time of appearance of a given form in relation to the forms which express the same notion in other languages. I will return to this point in the next chapter.

In the area of word acquisition, it has been argued that words map onto concepts that have already been developed non-linguistically. For example, Clark (1973) proposed that the child's first task in learning his language is to find out "how words and utterances should be mapped on to what he already knows" (p. 147). According to Clark (1974), the child actually takes in the information through his perceptual system from birth, and he has already obtained knowledge about his surroundings by the time he starts to utter his first words. Clark's

emphasis on the perceptual foundation for the child's conceptual knowledge constitutes the basis for her Semantic Feature Hypothesis (c.f. Chapter 3) and the explanation of the child's overextension errors, for example, the child's initial naming of animals such as horses and cows, "bow-wow."

In other studies, however, the assumption that the child uses meaning as a clue to a linguistic code is based upon the developmental work of Piaget who suggests that thought initially develops independent of language (Bloom, Lahey, Hood, Lifter & Fiess, 1980; Clancy, Jacobsen & Silva, 1976; Cromer, 1974; Macnamara, 1972; Slobin, 1973). For example, the developmental order of meaning relations between clauses in Bloom et al.'s study is explained in terms of the Piagetian studies. They found from data on four children that the first connective to emerge is and, expressing initially an additive relation, which is subsequently encoded with other meaning relations in the order temporal > causal > adversative. The result was interpreted in terms of conceptual knowledge studied by Piaget and his colleagues that "children learn to form collections of things ... before they learn to form series of things that are ordered relative to one another" (p. 258). Other connectives which refer to each specific meaning trailed behind and. In fact, Bloom et al. pointed out a constraint on the appearance of these connectives; the connectives which are already in use for other grammatical functions emerge later as connectives than those which are not. The constraint, a familiar one in the course of language development, is termed "grammatical uniqueness" by Prideaux (see further discussion in Prideaux, 1979 and Slobin, 1973).

In the studies listed above, the developmental relation between concept and language is assumed but there are some studies in which the relation is directly assessed in word acquisition (e.g., Siegel, 1978; Sinclair-de-Zwart, 1969; Trosborg, 1982; see Siegel for other related studies). While a heavy dependence on language to assess the child's conceptual knowledge is often criticized for the Piagetian approach (Miller, 1982), Siegel (1971), instead, advocated non-verbal tasks. She argued that verbal tasks adopted in the traditional Piagetian studies may lead to false negatives because the child's conceptual knowledge is usually filtered through relational words such as same, more, or less in conservation tasks. This result is confounded since the poor performance could be due to either the absence of the concept or the incomprehension of testing words. Siegel (1978) is an attempt to prove that the child's conceptual knowledge has actually developed prior to these relational terms.

Siegel (1978) devised non-verbal tasks to test quantity concepts, and compared performances on these tasks with those on verbal tasks for 3- and 4-year-old children. The non-verbal task was a concept attainment paradigm, in which the child was reinforced with a candy for a correct response to a stimulus. Concepts studied in Siegel (1978) are numerical difference and numerical equality. For the former, she designed the magnitude task in which a stimulus consisted of two sets of unequal number of dots. The child was rewarded on choosing the larger group of dots in the big condition (the smaller in the little condition). The language task which corresponds to the non-verbal task was a comprehension test of the words big and little. For

the concept of numerical equality, a match-to-sample technique was used; the children were reinforced for the choice of the same number of dots with the sample out of four alternatives. The corresponding language test asked the children to select the same number as the sample. The results in the magnitude task showed that while 44% of the 3-year-olds and 30% of the 4-year-olds passed the concept task and failed the language task, only 4% and 2% of these respective groups passed the language task without passing the concept task. In the equivalence task, 9% of the 3-year-olds and 14% of the 4-year-olds passed the concept and failed the language task. None of them passed the language task without passing the concept task. Accordingly, Siegel concluded that the concepts exist prior to the language referred to by these parameters. (See Bartlett, 1977, for the acquisition of big and little for other parameters and Richards, 1979 for a good summary for the acquisition studies of comparative adjectives). Another experimental work, Trosborg (1982), is an attempt to relate conceptual knowledge to the acquisition of words before/after to which I will return to later.

In the studies reviewed thus far, it is asserted that cognitive development is a prerequisite for linguistic development. In contrast, there is a suggestion that language in turn creates concepts (Markman & Hutchinson, 1984; Schlesinger, 1982). The researchers who argue for cognitive precedence, however, do not actually opt for "cognitive determinism," which postulates a one-way influence from cognitive to linguistic development (Schlesinger, 1982, p. 71). Other factors such as complexity of linguistic forms, or unique grammatical functions are considered to contribute to the overall linguistic development of a child.

2.3 Development of Event Knowledge

In the previous section, the relation between cognitive and linguistic knowledge was discussed. Although notions underlying language may be initially formed by the child's interaction with the environment independent of language, the interplay of concept growth and linguistic factors is considered to determine the acquisition of linguistic forms in the course of language development.

The focus of the present study, as explained in Chapter One, is on the acquisition of Japanese temporal connectives, which express a sequential or a simultaneous relation: they are Verb-te, sorekara 'and then,' mae 'before,' ato 'after,' toki 'when,' and aida and -nagara 'while.' In what follows, the function of the temporal connectives will be described, followed by a discussion of the development of the child's event knowledge. The relation of conceptual knowledge with language development will be discussed in the next chapter.

Connectives are relational words whose function resembles that of prepositions. Their meaning is hard to define. When Flores d'Arcais (1983) sought to examine the development of lexical knowledge in lexical and semantic decision tasks, he found that connectives are typically relational in character and that knowledge of these words develops much more slowly than for content words like nouns and adjectives. When compared to the connectives, adverbs are found to be semantically richer with their own meaning. Some English temporal words have other grammatical functions in addition to conjunctions. The corresponding Japanese words, except for -nagara, are all nouns,

which are used as connectives with or without a particle. Hence, if measured in experiments like those of Flores d'Arcais, these words may yield a somewhat different experimental outcome, to which point I will return later.

Thus, temporal connectives merely denote a temporal relation between clauses, sequential or simultaneous. The connective study by Bloom et al. (1980), as previously mentioned, clearly showed that a child starts to express his intended meaning relation by and preceding the use of a specific connective. In other words, a child must know the temporal relation of events observed between clauses before he produces sentences connected with temporal words and most probably, before he comprehends such structures. When does he acquire the conceptual knowledge of a temporal relation?

A discussion of the cognitive development of temporal concepts can be found in Piaget's studies, which are considered to be most fruitful on the issue of cognitive change in infancy (Miller, 1982). This period is subdivided into six stages depending on the infant's developmental behavioral patterns. According to Flavell (1963), Piaget devotes relatively few pages to temporal development in this stage. In his work on temporal concepts, Piaget (1969) mainly pursued the topic among older children. Yet some relevant information can be obtained from Piaget's observations of the infant in his early years. Already in stage 3 (4-8 months), a reference to the infant's rudimentary awareness of "a before and an after in the action-result sequence" is reported. About the same time, the child is able to keep track of an event in the very immediate past. The sequence of events, however, is

recognized only when the child's own action is involved in it. The transition from this stage to the next stage (8-12 months) is marked by the transition from the subjective to the objective temporal sequence. The child now has a capacity for retaining a memory of a sequence of events in which his action does not intervene. In fact, around this time the child starts to look for an object behind a screen where it is hidden. Piaget regards this behavior pattern as the first instance in which the child recalls an event rather than a past action (Flavell, 1963).

Thus, there is an indication that the child can notice a sequence of events as early as at the age of one, but how about a simultaneous relation? Piaget does not directly investigate the early developmental relation between sequence and simultaneity. It is pointed out in other studies that consciousness of simultaneous relations develop later than for sequential ones since it is harder for the child to perceive the former (Clancy et al., 1976; Ferreiro, 1971).

There are experimental studies reported which were designed to assess a developmental relation of sequence and simultaneity for 4- to 7-year-old children (Kayra-Stuart, 1980; Munro & Wales, 1982). Kayra-Stuart (1980) let the children imitate the actions performed by the experimenter in order to assess their non-linguistic knowledge about the following temporal relations: sequence and simultaneity with/without duration. She used body movements and manipulation of lights; for example, the experimenter pushed the red button and then the green button for testing the sequence. The simultaneous relation consisted of two conditions: no duration and duration. For the

former, she pushed the red and the green at the same time; for the latter, she pushed both buttons for 8 seconds. The imitation of the children showed no difference between the sequence (88% correct for 4-year-olds) and simultaneity (90% correct) of no duration. The simultaneity of duration, however, was found to be hard for the children.

Munro and Wales (1982) also employed the manipulation of lights in their non-verbal task. In addition, movement of colored beads was included in the task. They assumed that temporal data is coded in terms of a spatial or linear model; a simultaneous relation is coded by reference to one point and a sequential relation in terms of two points. Their assumption was evaluated both at the beginning and at the endpoint of a motion (e.g., an onset-offset of two coloured lights; the yellow light comes on, the red light comes on, the yellow light goes off, and the red light goes off). Munro and Wales varied the onset-offset combination of two lights so as to make six temporal patterns consisting of two durations. Out of the six patterns, sequential relation was easiest to imitate (80% correct for 4-year-olds), closely followed by simultaneous relation. This finding parallels that of Kayra-Stuart, although both sequential and simultaneous relations involved duration in this study. In Munro and Wales' study the length of duration was not specified, whereas Kayra-Stuart defined the simultaneity of long duration as 8 seconds. Sequences and simultaneity of no duration in her task were assumed to be instantaneous, and both of them turned out significantly easier than simultaneity of long duration. The poor performance in this condition may be due to incorrect

length of time, but not to the misrepresentation of the relation itself. According to Piaget (1969), children about the age 4 and 5 easily recognize simultaneity of two moving bodies travelling with the same speed starting out from and ending up in the same spot. Taken together, the conceptual knowledge of sequential and simultaneous relations is well-developed and not much different from each other for the children over the age of 4 as measured in the motor-imitation task as above. A developmental difference should be investigated with younger subjects. Keller-Cohen (1975) asked 3- and 4-year-old children to reproduce the experimenter's actions of sequential and simultaneous relations, each of which consisted of two actions; the boy kissed the mouse and then the girl pushed the car. The result demonstrated a significantly better performance for the sequential relation, but also a decrease in difference across age. This task, being more demanding than those employed in Kayra-Stuart (1981) and Munro and Wales (1982), makes a direct comparison impossible. After a careful examination of the data, however, Keller-Cohen argued against physical incapability of the young children. It can be concluded that sequence is acquired first.

We now turn to the study which addresses the question about when the child can relate one event as a reference point to the other in a sequential relation. The events in a sequence can be described in many ways: a juxtaposition of sentences, and then and before/after. The use of before/after is different from that of and then, as either one of events constitutes a reference point for the other in the former.

According to the naturalistic observation data of four languages by Clancy et al. (1976), children do not use before/after until significantly late, that is, they appear in the final stage in the development of temporal connectives. This result raises a question about whether the late appearance may be due to the formal complexity of these constructions or conceptual complexity underlying the forms. It is interesting in this regard to note that even the pair of before/after sentences, "C1 before C2" or "after C1, C2," in which the sequential order corresponds to the event order, appears late. The late emergence of these constructions, accordingly, may be due to conceptual complexity.

Ferreiro and Sinclair (1971) explained the relatively late emergence of before/after in terms of conceptual development. They asked children to describe two events acted out by the experimenter in the following two ways: (1) free-choice description, and (2) inverse-order description. In the free-choice questions, the children described the event as they liked, whereas in the inverse-order description they were asked to start a sentence with the description of the second event, that is, the event acted out last. When the children had difficulties with the latter type of description, when questions were employed to assess their knowledge of the temporal relationship. The age of the children ranged from 4;0 to 10;0. They were grouped into three categories based upon their performance. Ferreiro and Sinclair argued that the children's performance could be adequately explained only when the levels of their cognitive development were taken into consideration. The children of 4 and 5 years of age in the first category are totally preoperational and have not reached the

level of reversibility; they cannot see that "a return to the original state will result in exactly the same configuration" (p. 45).[1] They say children at this level describe the two events as separate entities; they simply juxtapose two sentences or just connect them with et 'and' and et puis 'and then.' Those in the second category have reached the level of reversibility, although they belong to the same age group as those in the first category and still are preoperational. They have a strong preference for an order-of-mention strategy (they describe events as they occur); yet their answers to the when questions are marked with correct temporal connectives. Finally, the children in the third category, succeeding in the conservation task, can perform correctly in all these tasks.

Ferreiro and Sinclair concluded that the children cannot produce before/after sentences, the clause order of which does not correspond to the event order (before C2, C1 or C2 after C1) until they are over 7, the age at which they first understand conservation and can deduce a temporal relation in a reverse way. It is interesting to note here that the younger children can give appropriate before/after answers to the when questions, even if they cannot comply with the inverse-order description. The problem for these children, accordingly, may rather be with the difficulty of the task, not with their inability to produce before/after sentences.

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[1]The irreversibility is the most important single characteristic of preoperational thought for Piaget (Flavell, 1963). The children in the level of irreversibility could not understand that the height of the liquid remains the same when it is poured back into the original glass after having been poured into a narrower glass.

The relation of cognitive development and comprehension of before/after sentences was also studied by Trosborg (1982). She gave 3- to 6-year-old Danish children a verbal judgment task and an act-out task for assessing language. For testing conceptual knowledge, a spatial seriation task, a picture seriation task, and a conservation task were conducted. All those concept tasks are assumed by Trosborg as being relevant to the acquisition of before/after sentences. Among the three concept tasks, the spatial seriation task requires the children to seriate things like sticks in a size order. The rationale for use of this task is given by Trosborg as follows: complete understanding of temporal notions cannot be expected until time, movement, and velocity concepts fully develop (Piaget, 1969), whereas for understanding of the temporal notion underlying before/after, only spatial grouping is needed according to Katz's semantic theory (1972).[2] Hence, the child's ability to relate various items according to size or length, etc. on a continuing scale is considered a prerequisite for development of before/after. The picture seriation task attempts ~~to~~ evaluate the child's ability to make up a story from events depicted on separate cards in terms of temporal or causal relations. The conservation test measures the concept of reversibility.

Trosborg found a significant correlation between all those tasks with the performance on before/after sentences, thus concluding

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[2]The theory is adopted by Trosborg because she considers the semantic notions developed by Katz to be very similar to those of cognitive theory representing time in spatial terms.

that "a cognitive basis for a comprehension of these conjunctions has been established" (p. 401). It should be noted, however, that the correlation between the concept tasks and language test does not necessarily lead to the conclusion stated above. Her data demonstrates that none of the youngest children in Group 1 could carry out the conservation test. Yet the same children obtained 16.3% correct responses for both reversed before/after sentences, that is, before C2, C1 and C2 after C1. If the concept under study is prerequisite for the acquisition of before/after sentences as Trosberg claims, a correct performance cannot be expected from children who failed in the concept test. The result raised doubts of whether concepts such as reversibility measured in the conservation test should exist before the development of before/after constructions.

Apart from the reversibility, the before/after sentences may still be conceptually difficult compared to and then sentences. While the child simply describes the events in their occurring order in the latter, he has to retain separate events in his memory and then reorganize them using one event as a reference point in the former. Since the sensory-motor intelligence (0-2 years) is only able to link successive events one by one, and the capacity for simultaneous and all-encompassing purview of all the events belongs to the preoperational period (2-7 years) (Flavell, 1963, p. 151), before/after sentences are predicted to develop later.

2.4 Summary

In this chapter, the relationship between cognitive and linguistic development was discussed. Although it is generally agreed that notions underlying language develop initially independent of the language, other linguistic factors are considered to contribute to the overall linguistic development of a child.

Based on the Piagetian studies, as well as other experimental studies, it is proposed that the conceptual knowledge of a sequential relation develops earlier than that for a simultaneous relation. In addition, the sequential relation underlying before/after sentences is considered to develop later. Consequently, it is assumed that the developmental order of temporal notions is sequence > simultaneous > the sequence of before/after, which in turn should predict the acquisitional order of temporal connectives. In the next chapter, this assumption will be evaluated in terms of empirical data. Linguistic factors which may influence the development of those connectives will be included in the discussion.

3. EMPIRICAL STUDIES OF TEMPORAL CONNECTIVES

3.1 Introduction

In English a sequence of events is expressed in many ways: e.g., by juxtaposition of clauses or by use of connectives such as and then, before and after. Connectives when and while express events occurring simultaneously. Sentences linked by all of these connectives appear in children's language data of their first five years (Clancy et al., 1976). Many other experimental studies have been conducted to investigate the acquisition of those connectives. The present study is concerned with the acquisition of Japanese complex sentences corresponding to English sentences linked by and then, before, after, when and while.

This chapter consists of four sections. First, Japanese temporal connectives are described. Secondly, developmental studies of temporal connectives are reviewed, and then the prediction for the developmental order of these connectives is evaluated in the light of the studies. Finally, the hypotheses of the present study are stated.

3.2 Japanese Temporal Constructions

Japanese connectives chosen for the present experimental study are V-te, sorekara, 'and then,' mae 'before,' ato 'after,' toki 'when,' and aida and -nagara 'while.' While they share the same linking function as their English counterparts, the structure of temporal clauses is different from English. This section has two parts. Sentences expressing a sequential relation are first described, followed by a discussion of sentences expressing a simultaneous relation.

3.2.1 Sentences expressing an event sequence

English sentences connected by and differ syntactically from before/after sentences; the former are composed of coordinate clauses and the latter of a main and one or more subordinate clauses. Semantic relationships in the and sentences are also different from those in the before/after sentences. The clausal relationships in and sentences are quite varied, whereas before/after clauses generally imply only a temporal relation (but see Townsend and Ravelo, 1980). The same semantic clausal characteristics can be observed in the corresponding Japanese constructions.

Japanese equivalents for and sentences are sentences connected by Verb-te, which is the gerundive form of the verb. It is formed by adding -te or -de to the verb stem, the choice phonologically conditioned by the stem, i.e., hanasite for hanasu (to speak) and yonde for yomu (to read). Being the gerund, the -te form does not produce coordinate independent clauses as and does, but rather coordinate verb phrases.

However, among its semantic linking functions is one that parallels that of and. And indicates merely a relation between the clauses (Quirk, Greenbaum, Leech and Svartvik, 1972). The function of the V-te form also is that of merely connecting clauses (Alfonso, 1980). Martin (1975) lists nine types of semantic implications for the V-te sentences, one of which is a temporal sequence. Observe the following examples:

(1) John wa ha o migaite, neta.
TM teeth OM brush slept

John brushed (his) teeth and slept.

where "TM" and "OM" indicate the topic and object markers respectively.

(2) Mary wa sara o aratte, huita.
dishes wash wiped

Mary washed the dishes, and wiped (them).

More than two clauses can be connected by use of V-te form as shown in (3):

(3) Mary wa sara o aratte, huite, simatta.
put away

Mary washed the dishes, wiped (them) and put (them) away.

When the subject of the first clause differs from that of the second clause, the clausal relationship denoted is simple conjoining as in (4).

(4) Mary ga sara o aratte, John ga huita.
SM

Mary washed the dishes and John wiped (them).

where "SM" indicates the subject marker.

Accordingly, the connective sorekara is attached to the V-te form in order to make the sequential relation between clauses explicit, as in (5).

(5) Mary ga sara o aratte, sorekara John ga huita.

Mary washed the dishes and then John wiped (them).

Japanese has expressions corresponding to before/after sentences (Kuno, 1973; Yamada, 1980). Yamada (1980) lists mae as an equivalent for before and V-te kara, ato, ato ni and ato de as equivalents for after. Japanese sentences using these counterparts differ syntactically from English ones.[1] With the exception of the V-te

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[1]Heinamaki (1978) presents an argument that English temporal clauses are relative clauses.

kara, these time words are nouns: mae means 'front' or 'before' and ato means 'after.' The temporal clauses of mae and ato are composed of a time noun modified by a clause which functions adverbially in the sentence. The same syntactic characteristics apply to other temporal terms to express simultaneity of events: toki 'time' or 'when' and aida 'interval' or 'during the time when.' The following are examples of mae sentences:

(6) Neru mae ni ha o migaku.
sleep

Before (I) sleep, (I) brush (my) teeth.

(7) Neru mae ni ha o migaita.

Before (I) slept, (I) brushed (my) teeth.

As observed in sentences (6) and (7), the V-ru form must be used in the mae clause regardless of the tense of the main verb. The tense categories of Japanese verbs have two subcategories: past and non-past, of which the past is expressed by the V-ta form and the non-past by V-ru form. In addition to marking the tense, these two forms also denote aspect. The V-ru form indicates incompletive and the V-ta form completive. Since the V-ru form preceding mae denotes the incompletive aspect, it does not inflect according to the tense of the main verb (Soga, 1983). I will come back to this point again later when Japanese tense and aspectual systems are discussed.

Kuno (1973) points out that there is another sentence construction which may correspond to the English before sentences: this uses the connective uchi ni 'while.' There is sentence (8) which matches sentence (6):

(8) Nenai uchi ni ha o migaku
sleep-not while

(I) brush (my) teeth while (I) do not fall asleep.

Kuno observes that when uchi ni is preceded by the negative form of action verbs, it acquires a meaning close to mae. However, there are some subtle differences of meaning between sentences (6) and (8). According to Kuno, when mae is used, the speaker knows when something is going to happen. Uchi ni, on the other hand, is used "when the speaker knows that something is about to happen but is not certain when it is to happen" (p. 154). Sentence (6) shows that the speaker knows that he will go to bed and that he is brushing his teeth before that time, whereas sentence (8) shows that the speaker does not know when he will get sleepy and go to bed, but he is brushing his teeth just in case he gets sleepy.

The meaning of uchi ni is such that it cannot be used in relating events which should occur at definite times in the experimental situations. There is also a question whether young children can understand such subtle meaning differences between mae and uchi ni. Accordingly, only mae sentences will be included in the present study.

As to English after sentences, Yamada (1980) gives ato, ato de, ato ni and V-te kara as their equivalents. The V-te kara is in the form of the gerund followed by kara 'from' (Kuno, 1973). Martin (1975) observes the differences between the V-te kara and ato de clauses in the following way (p. 507):

> The expression V-te kara usually implies a logical (causal?) or temporal sequence and often has the same subjects as the new sentence ... The expression V-ta ato de 'after doing' implies

> nothing about sequence except to tell you that the act of the second sentence occurred at some point later in time than the act of the first; as with all such time expressions (V-ru mae ni, V-ru aida ni, V-ru uchi ni, etc.) the subjects may be the same or different.

Acknowledging that Martin's observations are correct, Kuno (1973) places further constraints on the use of the V-te kara. According to him, the temporal relationship between clauses in a V-te kara sentence should be one intentionally controlled by the subject. Kuno also takes note of the differential meanings of ato de and ato ni. The ato ni construction is used when the vacuum left by the first clause is filled by the second clause. Compare the following two sentences quoted from Kuno.

(9) John ga kaetta ato ni, Mary ga yattekita.
left after came

After John left, Mary came.

(10) *John ga kaetta ato ni, Mary ga kaetta.

After John left, Mary left.

Sentence (10) is ungrammatical because the vacuum caused by John's departure is not filled by Mary's leaving. Kuno states that ato de does not have such a constraint on its use, but ato ni and ato de can not be used in the sense of ever since. He concludes that ato is the most neutral of the forms discussed.

The constraint on the use of the V-te kara proposed by Kuno, however, was refuted by Yamada (1980). Yamada does not find any intentionally controlled time sequence between clauses in the V-te kara sentences. He attributes Kuno's interpretaton to the fact that the second event takes place immediately after the first event in those

sentences, so that they sometimes give the impression that the subject has been purposefully waiting for the time of the completion of the first event. I agree with Yamada's view. Because of the unclear semantic implications of many of these constructions, the sentence constructions chosen for the present study are the most neutral ato sentences.

3.2.2 Sentences expressing simultaneity of events

As mentioned in the previous section, the Japanese structures corresponding to English temporal clauses with when and while are composed of a time noun modified by a clause: the time nouns are toki 'time' or 'when' and aida 'interval' or 'during the time when.' Both temporal nominals toki and aida express events occurring simultaneously. Aida means 'the space between' or 'the space extending over' and the concept can also be applied to temporal notions (Alfonso, 1980). Thus, aida signifies the interval in which an event or a process occurs over an extended time, whereas toki merely signifies the point at which the event happens (Yamada, 1980). Accordingly, the verbal phrase preceding aida should be the one which denotes duration. A discussion of the types of the verbs, e.g., durative, stative, will follow shortly.

Japanese has another construction, a suffix -nagara which is equivalent to while. This formative attaches to action verbs which signify duration, and expresses the action occurring simultaneously with the action expressed in the following verb. The description of these temporal constructions will follow a brief discussion of Japanese

tense and aspectual systems, since these play integral parts in defining the meaning of the temporal constructions.

As previously discussed, the Verb -ru form and -ta form express aspect as well as tense in Japanese. The -ta form denotes the past tense and the -ru refers to the events or states in the present and future. As to aspect, the -ta form signifies the completive aspect, and the -ru the incompletive aspect. Soga (1983) explains the use of the -ru and -ta forms by quoting from Miura (1974), who categorizes these two forms on the basis of two fundamental temporal notions of 'earlier T-R' and "non-earlier T-R' (T-R represents Time-Relationship).

> V-ru expresses the situation of 'non-earlier T-R,' which signals "a particular event as not completed earlier than another event or earlier than the moment of speech," and ... V-ta expresses the 'earlier T-R,' which indicates a particular event as completed earlier than some other event or earlier than the moment of speech." (Soga, 1983, p. 39).

A similar idea was expressed by Ota (1982). He states that the -ta is used in main clauses or in simple sentences when the event referred to occurred earlier than the speech time; otherwise, the -ru is used. The use of these forms in the subordinate clause depends on the relative temporal order of the event in this clause to that in the main clause: if the former is earlier than the latter, the -ta is used and if later, the -ru is used (see also Joseph, 1972). Soga (1983) argues that viewpoint shift or the 'realized' aspect should be taken into consideration to explain the use of the -ru and -ta forms in addition to the completive-incompletive aspect. For example, the -ta form is used in conditional construction which expresses the suppositional action, event, or state.

(11) Motto yasukatta-ra, kaimasu.
more if was cheap buy

If (it) was cheaper, (I) would buy (~~it~~).

It is claimed by Soga that the -ta form of 'to be cheap,' being stative, should be better explained in terms of the aspect 'realized' rather than completive; namely, realized prior to the second event.

These aspectual characteristics of the -ru and -ta forms are exemplified in the temporal structures of mae ni 'before' and ato 'after.' Since the event in the mae ni clause always follows that in the main clause, the verbal phrases in the embedded clause of mae ni 'before' should be in the V-ru form regardless of the tense of the main clause. The verbs in the ato 'after' clauses, on the other hand, should be in the V-ta form since the event in these clauses occurs prior to that in the main clause.

These differential aspectual characteristics of the -ru and -ta forms affect the meaning of toki 'when' sentences, as well. Observe the following toki sentences taken from Soga (1983, p. 71).

(12) Kyonen Yokohama ni {iru / ita / is / was} toki Tanaka-san ni atta.
last year in when Mr. Tanaka with met
When (I) {(lit.) am in / was} Yokohama last year, I met
Mr. Tanaka.

(13) Yokohama ni {iku / itta} toki Tanaka-san ni atta.
When (I) {(lit.) go / went} to Yokohama, (I) met Mr. Tanaka.

In sentence (12) the stative verb iru 'to be' is used, while in (13) non-stative verb iku 'to go' is used. Soga states that the change of the -ru to -ta does not affect the meaning of sentence (12). It

signifies the simultaneous event relations of the embedded and main clauses since stative verbs specifically indicate incompletive, durative aspect regardless of the tense. In other words, both the -ru and the -ta forms express a durative state, in which the event in the main clause occurs. The replacement of -ru by -ta in the toki clause in sentence (13), however, changes the meaning of that sentence. The -ru indicates that the event was incomplete at the time when the event in the main clause took place, resulting in the meaning, '(I) met Mr. Tanaka on my way to Yokohama.' On the other hand, the most natural interpretation for -ta in the toki clause is that the event in it precedes that in the main clause, that is, 'After (I) went to Yokohama, (I) met Mr. Tanaka.' A similar temporal relation in when clause in English is pointed out by Quirk et al. (1972). Referring to a sequence of past events, they say that "When and the simple past tense (probably the most popular choice) suggest that the one event followed immediately on the other" (p. 783).

(14) When he returned from work, his wife cooked dinner.

Furthermore, they also make comments on the expression of simultaneity (p. 783): "if the verb phrase of the main clause is progressive in aspect or contains a stative verb, when indicates the simultaneity, rather than successivity of events:

(15) When he returned from work, his wife was (cooking dinner) in the kitchen.

Heinamaki (1978) tries to define the time specification of the when clause to the main clause based on the classes of the verbs appearing in both when and main clauses. The verbs considered are those of non-duration, duration and accomplishment. Ogawa (1985) makes

a similar attempt to specify the temporal relation of toki clauses. She classified Japanese VPs in four categories according to Vendler's (1967) VP categories: achievement, accomplishment, activities and states. The fifth category, specific to Japanese verbs, was added to those four categories. Ogawa, then, described the temporal relation of the toki clause to the main clause based on the combination of the types of verbs in both toki and main clauses. The following sentences (16) to (19) are quoted from Ogawa (1985), all of which have an achievement verb in the main clause.

(16) Sensei ni au toki Taroo mo sasotta.
teacher meet Taroo too invited

When (I) (lit.) meet a teacher, I invited Taroo, too.

(17) Taroo wa watasi o mita toki nikkori waratta.
me looked at smiled

Taroo smiled when he looked at me.

(18) Kimono o kiru toki sode no ura o yabutta.
kimono wear sleeve of lining ripped

When (I) (lit.) wear the kimono, (I) ripped the lining of the sleeve.

(19) Kimono o kita toki sode no ura o yabutta.

When (I) wore the kimono, (I) ripped the lining of the sleeve.

In sentences (16) and (17), the toki clause has -ru or -ta form of an achievement verb, whereas in sentences (18) and (19) it has an accomplishment verb. Ogawa states that in sentence (16) the temporal relation of events described expresses a reversed relation of an order of occurrence of events, while in (17) it corresponds to the order-of-mention or it may be simultaneous. The sentences which have an accomplishment verb in the toki clause, i.e., (18), express a reversed

relation of the order of occurrence of events just like (16), or the event in the main clause occurs at the interval defined by the toki clause, namely, expressing a simultaneous relation. Finally, (19) denotes the relation of simultaneity or an order-of-mention.

The temporal relation between the clauses depends not only on the kind of verbs but on whether the events can co-occur, as the following examples show:

(20) Gohan o taberu toki te o aratta.
meal eat hand washed

When (I) ate a meal, (I) washed my hands.

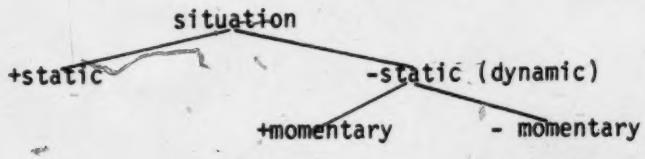
(21) Gohan o taberu toki terebi o mita.
TV watched

When (I) ate a meal, (I) watched TV.

(20) demonstrates succession of the events and (21) simultaneity, because the natural interpretation for (20) is that we wash our hands before the meal, whereas we can watch TV when we eat.

The Japanese equivalent to an English word while is aida. The aida clauses express the simultaneous relations of events over an extended time. The verbal phrases in the embedded clause are naturally the ones which denote duration. It is necessary at this point to explain which kind of verb or verb phrase signals duration of events in Japanese. In what follows, characteristics of verbs will be briefly discussed.

Lyons (1977) categorizes situations on the basis of the organization of our perception of the physical world in the following way:



These situations are represented by respective English verbs: stative verbs for the static situations and non-static verbs for the dynamic situations. Lyons claims that when the dynamic situation is momentary, it is an event and when it is extended over time, it is a process. The term event in his sense differs from ordinary use of event which includes events as well as processes. The term event in this study is used to represent the situation '-static.'

Japanese verbs are also grouped into stative and non-stative verbs. It should be noted that although the grammatical characteristics of the stative verbs are similar to those of English, the verbs lexicalized as stative verbs do not parallel those of English. Typical Japanese stative verbs are existential verbs and potential verbs (e.g., iru 'to be' and yomeru 'to be able to read'). Soga (1983) lists the criteria of a stative verb, from which those relevant to the discussion of the temporal constructions are quoted in the following (p. 88):

(19) a. No progressive forms.
b. Tense form replaceability - the non-past tense form may be replaced by the past tense from under certain conditions.
c. Suffix -nagara co-occurs expressing only the counter-to-expectation meaning, never the simultaneous meaning.

Soga (1983) states that (19a) and (19b) are two of the most important features that distinguish stative from non-stative verbs. (19a) is obvious because the progressive form represents both stativity and incompletiveness in the same way most stative verbs do. (But see Fletcher, 1979 for a difference of English progressives from Japanese counterparts.) Point (19b) was already discussed in the section of the toki clause. I will come back to (19c) later.

The non-stative verbs are further divided into two groups: durative and punctual, which may correpond to verbs representing Lyons' processes and events. Some of the semantic and grammatical characteristics of durative and punctual verbs are listed by Soga as follows:

Durative verbs (p. 107):

(20) a. Semantically, durative verbs express the meaning of action, events of processes which are perceived to require an appreciable amount of time from inception to termination.
b. When durative verbs occur in the construction -te iru, they can express the meaning of 'on-going' actions or events.
c. If these verbs occur in an embedded sentence with the morpheme -nagara, they express the meaning of simultaneity of the actions expressed by them and the main verbs.

Punctual verbs (p. 107):

(21) a. Punctual verbs are conceived not to require a time interval. Their meanings are perceived in such a way that inception and termination are simultaneous.
b. When punctual verbs occur in the -te iru construction, they express only a resultative meaning.
c. When they occur with the morpheme -nagara, they express the meaning of 'counter-to-expectation.'

As shown above, the suffix -nagara has a distinct role to separate stative from non-stative and durative from punctual verbs: it expresses the simultaneity of events when attached to durative verbs, but the counter-to-expectation with stative and punctual verbs. The subject of embedded and main clauses in all these constructions must be one and the same. Observe the following examples taken from Soga (1983):

(22) Kare wa okane ga takusan ari-nagara, itumo ketikusai.
he money a lot exist always stingy

In spite of the fact that he has a lot of money, he is always stingy (p. 95).

(23) Daigaku o de-nagara syoku ni tukenai
college graduated job at get

Although (he) graduated from college, (he) cannot get a job.

(24) Benkyo-si-nagara terebi o mita.
(I) watched TV as (I) studied
(I) studied as (I) watched TV.

Only (24) expresses the simultaneity of the events. The verbs in other sentences are the stative verb aru 'to exist' and the punctual verb deru 'to graduate.' Some punctual verbs, however, do not represent the meaning of counter-to-expectation when combined with -nagara. For example, tatsu 'to stand up' is classified as a punctual verb, but the following sentence does not indicate the meaning of counter-to-expectation.

(25) Tati-nagara tabeta.

(I) ate while standing.

The construction may represent the state of having resulted from an antecedent action (Kindaichi, 1976).

Coming back to the aida 'while' clauses, the semantic features of aida are just the same as while except that the interval referred to by aida is definite (Alfonso, 1980; Yamada, 1980). Yamada illustrates the meaning of aida in the following English examples:

(26) While I was reading, he left.

(27) While I was reading, I fell asleep.

If the time interval in which the reading took place was clearly defined, aida can be used in the Japanese translation of (26). In (27), however, aida cannot be used because the speaker fell asleep while reading: the interval is one with undefined boundaries. Another construction, uchi ni, would be appropriate in this situation.

Compared to aida, as discussed before, uchi ni has many constraints on the semantic relationship between its embedded and main clauses. Consequently, aida is employed in this study.

As noted before, the verb phrases in the embedded clause of aida should be verbs signifying duration such as stative and durative verbs. In addition, V-te iru forms of both durative and punctual verbs can occur in the embedded clause. The V-te iru expresses the progressive aspect combined with the durative verbs and the resultative state with the punctual verbs. Since both denote durative situations, they tend to occur in the aida clauses (refer to the sample sentences in Alfonso, 1980 and Asano, 1975). Furthermore, the V-te iru in the main clause expresses the total inclusion of its state within the state defined by the aida clause, in comparison to the undefined, partial inclusion denoted by durative verbs.

(28) Gohan o tabete iru aida terebi o mite ita.
While (I) was eating a meal, (I) was watching TV.

(29) Gohan o tabete iru aida terebi o mita.
While (I) was eating a meal, (I) watched TV.

Since one of the main objectives in the present study, as explained later, is to investigate the child's comprehension of the interaction of a connective and aspect, both of these sentence constructions are included in the study as stimulus sentences.

3.3 Empirical Studies

Clark's proposal of the Semantic Feature Hypothesis in the acquisition of temporal terms (1971) has attracted considerable

attention to before/after sentences. In fact, it is now one of the most well-researched areas in the acquisition of relational terms. Consequently, developmental studies of before/after sentences are first reviewed in this section, followed by a discussion of the acquisition of sentences expressing a sequential and a simultaneous relation. The predicted developmental order of temporal notions is evaluated in light of the results of these studies. Finally, local cues and their implications for the acquisition of Japanese temporal connectives are discussed.

3.3.1 The Semantic Feature Hypothesis

Clark (1971, 1973) proposed the Semantic Feature Hypothesis to account for the acquisition of word meaning. Her work has since stimulated much research in a field which had previously been largely neglected. Researchers were attracted to the hypothesis largely because it claimed to offer a general explanation for word acquisition.

Clark claimed that the meaning of a word is composed of semantic features. These features are, in the earliest stage of language development, assumed to be perceptual attributes such as shape and size. In the acquisition of word meaning, the child will begin by identifying meanings with only one or two features rather than with a whole combination of features. Later, the child will gradually add more features of meaning to a word until the combination of features matches that of the adult's lexical entry. Furthermore, if the features which make up the meaning of a word are hierarchically related to each other, the order of their acquisition is assumed to be "top-down";

that is, the top feature which is most general is acquired first, with the other features acquired in their order of hierarchical dependence. A good example of a hierarchical organization of features is that of temporal terms such as when, before and after.

Clark (1971) explains the feature composition of these temporal terms in the following way. The most general component which dominates the other features is Time. +Time refers to some aspect of time. The next feature, Simultaneous, has two values: ±Simultaneous. +Simultaneous indicates a punctual relation between events and -Simultaneous, a serial relation. The last features, ±Prior, dominated by -Simultaneous, specifies whether one event precedes or follows another, respectively. Clark cites a linguistic argument in addition to developmental observation for the developmental order of ±Prior. The word which contains +Prior, before constitutes a positive member of the pair before/after due to its close relationship to a spatial prepositional complex, in front of. Front is positive since it refers to the visible perceptual field, whereas its opposite behind is negative, which refers to the area that is out of sight.

The hierarchical organization of these components is as follows: (Clark, 1971, p. 273)

(1) when: +Time
+Simultaneous

(2) before: +Time
-Simultaneous
+Prior

(3) after: +Time
-Simultaneous
-Prior

The words are listed according to the acquisitional order by Clark.

Clark's claim of the feature organization of these terms is based on her results of both comprehension and production tasks in which the following types of sentences were adopted.

(4) He jumped the gate before he patted the dog. (before 1)

(5) After he jumped the gate, he patted the dog. (after 1)

(6) Before he patted the dog, he jumped the gate. (before 2)

(7) He patted the dog after he jumped the gate. (after 2)

These sentences will be hereafter referred to by their respective terms in the parentheses. Subscript 1 is attached to the sentences in which the order of events described corresponds to the order of occurrence of events, while subscript 2 indicates the sentences expressing a reversed relation of these orders.

Clark grouped the children in her experiment in four stages according to their performances in the comprehension task. The children at Stage I simply ignored connectives and acted out events in the order they were mentioned in the sentence (an order-of-mention strategy). The strategy consistently led them to a correct interpretation of before 1 and after 1, but not of before 2 and after 2. At Stage II, all before sentences are mostly correct, but the children still applied the order-of-mention strategy to after sentences at Stage IIa, but those at Stage IIb interpreted after as if it means before. In other words, the children's performances of before are always correct, while those of after are all wrong. Clark considers this particular response pattern to be an overextension of before (+Prior) to after (-Prior). Finally, the children at Stage III differentiated meanings of before/after, so that they provided appropriate responses to these sentences.

Clark also referred to some evidence from the production task for the acquisitional pattern of before/after above.

The overextension of before to after in Stage IIb was favorably compared by Clark (1973) to the acquisitional patterns of other relational terms such as more/less and same/different. Clark argued that, for all these relational terms, the term that is overextended happens to be acquired prior to the other pair.

Clark's work, as mentioned before, subsequently stimulated interest in before/after sentences, the development of which has been extensively investigated in following years (Amidon & Carey, 1972; Coker, 1978; Ehri & Galamis, 1980; Feagans, 1980; French & Brown, 1977; Goodz, 1982; Harner, 1976; Hatch, 1971; Johnson, 1975; Kayra-Stuart, 1980; Kavanaugh, 1979; Keller-Cohen, 1975; Slobin, 1982; Townsend & Ravelo, 1980; Trosborg, 1982).

A central issue in the studies which followed Clark (1971) has been about her claim that before is acquired earlier than after, which is initially treated as synonymous with before. The results of subsequent studies have shown that the acquisitional order of before/after is not as uniform as Clark had claimed. It interacts with sentence types; commands or statements (Amidon & Carey, 1972; Johnson, 1975) and logical or arbitrary sentences (French & Brown, 1977; Kavanaugh, 1979), and also with tasks; an imitation or an act-out or a reaction time (Keller-Cohen, 1975; Townsend & Ravelo, 1980). A general tendency of before > after can be obtained if experimental sentences are statements such as those used in Clark and if tested in an act-out task (Feagans, 1980; Goodz, 1982; Trosborg, 1982; but not confirmed in Keller-Cohen, 1975), but some children reportedly performed correctly on after

sentences while adopting the order-of-mention strategy on before sentences (Coker, 1978). Thus, Coker suggests that "some children may learn after first and some children may learn before first, contradicting Clark's principle that the positive aspect of a feature is learned before the negative aspect" (p. 265). Meanwhile, Coker points out an alternate explanation to Clark's claim of overextension errors of before to after. I will return to this point later.

The only consistent result which emerges from most of the studies is the child's employment of the order-of-mention strategy. In addition to the order-of-mention strategy, a couple of other sentence processing strategies have been proposed to account for the children's response patterns of before/after sentences. In what follows, these strategies will be briefly described.

Smith and McMahon (1970) conducted question-answering and verbatim recall studies of before/after sentences with adults as subjects. They suggested a Main Clause Saliency Strategy to account for the subjects' responses to before/after clauses: information in main clauses is easier to interpret than information in subordinate clauses because the former is unequivocally asserted to be true.

Another main clause hypothesis was proposed by Bever (1970). Bever's hypothesis consists of two principles: (1) in comprehension, the assertion of a sentence is the basis and the presupposition is organized as psychologically subsidiary to it; (2) in the comprehension of ordered events, the relations are organized by starting with the first event, with other events subsidiary to the first (p. 286). Bever's hypothesis predicts before sentences are easier than after sentences since the main clause which contains the assertion describes

the first event in the former, whereas in the latter the assertion in the main clause describes the second event. Bever (1970) presented a corroborative result for his hypothesis from an act-out task with small children. It should be noted here that Bever's hypothesis predicts the same result in comprehension of before/after sentences as Clark's Semantic Feature Hypothesis: before sentences are easier than after sentences. As previously discussed, the results at the present time are not conclusive enough to give support to either of the hypotheses, although Coker (1978) presents an argument for Bever's hypothesis.

In contrast to Bever's hypothesis, the Main Clause Saliency Strategy proposed by Smith and McMahon simply predicts the ease of processing of the main clause. The results of Amidon and Carey (1972) agree with Smith and McMahon's hypothesis. Amidon and Carey used commands as sentence stimuli: "move a blue plane before you move a red plane." They found that among their subjects the order-of-mention strategy was not dominant. Instead, the subjects paid much attention to the main clause, while making many omission errors in the subordinate clause. Amidon and Carey interpreted their result in terms of the Main Clause Saliency. Their study was subsequently replicated by Johnson (1975). Pointing out the difference of sentence stimuli used in Clark (1971) and Amidon and Carey (1972), Johnson argued that the omission errors in the subordinate clause could be attributed to the use of the commands instead of statements as experimental sentences. Consequently, Johnson included both types of sentences in her experiment. In her results, Johnson obtained some qualitatively different error patterns for respective tasks; omission errors in the command task and reversal errors in the comprehension (statement) task.

According to Johnson, children in the command task responded only to a direct command in the main clause, since in complex sentences with before/after only the main clause action is directly instructed. Johnson referred to the result in Amidon and Carey's feedback condition as evidence: when the children were reminded that the subordinate clause also expressed a direct command, their omission errors substantially decreased.

As shown above, various proposals have been made for processing before/after sentences. A question arises as to whether these strategies serve as a processing strategy per se employed only in the experimental situations or whether they function in language acquisition. Bever explicitly states that his hypothesis is postulated for the purpose of sentence comprehension, while Smith and McMahon are not specifically concerned with developmental studies. In this regard, Bever (1970) called attention to the result that children initially tend to repeat only one of the clauses in sentences like (8), when asked to repeat the sentence ("the elephant likes the pig" or "the elephant bit the cow").

(8) The elephant that likes the pig bit the cow.

Two and a half year old children, however, have a tendency to repeat the main clause if they repeat only one of the clauses ("the elephant bit the cow", p. 289). The same tendency is noted by Slobin and Welsh (1973) in their elicited imitation study, but Slobin and Welsh present the following type of imitation more often than imitation of only the main clause by their subject of about the same age as those in Bever's study.

(9) MOZART WHO CRIED CAME TO MY PARTY (Model)
Mozart cried and he came to my party (Imitation)

It is not known whether there is a developmental stage at which the child only processes the main clause of sentences like center-embedded relative clauses. (Many developmental studies of relative clauses do not generally analyze omission errors in their results.) Townsend and Ravelo (1980) also mention inconclusive results as to the Main Clause Saliency in developmental studies of other sentence constructions carried out by Townsend and his colleagues.

It was previously pointed out that most developmental studies of before/after sentences confirmed the use of the order-of-mention strategy by children. The strategy is reported to be operative in developmental studies of other sentence constructions such as because (Emerson, 1979). The fact that the child is a committed user of this strategy is shown by sequential errors made on sentences expressing a simultaneous relation (Kayra-Stuart, 1980; Keller-Cohen, 1975). It is remarked by researchers that the strategy is usually adopted by children who have not learned the meaning of connectives. It is also suggested that the strategy is restricted to enactment tasks in which the child has to act out sentences or with production tasks in which the child has to describe a temporal sequence of events in sentences (Emerson, 1979). In fact, Kayra-Stuart (1980) reported that the strategy was not employed in the verbal imitation task. In contrast, the use of the strategy was observed both in verbal imitation and comprehension tasks in Keller-Cohen (1975). The effect of the strategy is also shown in the verbal judgement task of Trosborg (1982).

It is interesting that the tendency to use the order-of-mention strategy is also observed in comprehension of logical sentences.

French and Brown (1977) and Kavanaugh (1979) both compared children's performances of logically constrained sentences to those of arbitrary sentences: "After Raggedy Ann takes off the hat, she brushes her hair" versus "After Raggedy Ann puts the baby to bed, she takes of her hat." Temporal terms are found to be better comprehended when they are constrained by the child's knowledge of the world. Neither of the researchers analyzed the effect of the strategy upon logical sentences as separate from arbitrary sentences, yet the tendency to use the strategy upon logical sentences is noticeable.

The relation of the use of the order-of-mention strategy to age is also pointed out. Feagans (1980) states that this strategy is used by 3-year-olds. In the analysis of reaction time and errors of before/after sentences, Townsend and Ravelo (1980) also noted that the strategy is used by 3-year-olds. A shift of strategy occurs at the ages of 4 and 5, but adults adopt the order-of-mention strategy.

Finally, how do naturalistic observation data address the order-of-mention strategy? Cromer (1974) remarked, after examining data from Adam (Roger Brown's subject), that Adam first used before/after in a way which retained the actual order of events. Clark (1970) also identified the strategy in the children's spontaneous production of complex sentences with temporal connectives. Taking all the results into consideration, it appears that the order-of-mention strategy cannot be dismissed as a processing strategy which is only available for use in experimental situations. It seems likely that the child exploits this strategy for comprehending and producing sentences in his everyday life outside the laboratory.

In the foregoing review of studies, before/after function as subordinate conjunctions in sentences, both of which, however, also have functions as adverbs and prepositions. These terms are reported to appear earlier as adverbs and prepositions than as connectives in the course of language acquisition (Clancy et al., 1976; Clark, 1970). The acquisition of the prepositions before/after was experimentally investigated by Coker (1978) and Harner (1976). Coker reports that before/after are first acquired as prepositions and then as subordinate conjunctions. Both researchers found the preposition after is easier than before. Coker employed two prepositional tasks, in one of which a set of three pictures (e.g., bike, car, truck) was shown to children in a serial order. The children were asked to memorize the order, and then asked the questions: "What did I show you before/after the X?"

Harner prepared three bags, each containing a set of toys. On the day preceding testing, children played with a set of toys held in one of them. On the testing day, Harner brought all three bags, the toys in one of which were first identified as the ones the children had already played with. Next, she showed the toys the children would play with the next time they come. Finally, the children were introduced to the toys to be played with on that day. The questions put to the children were: "Show me a toy for after this day" or "Show me a toy from before this day."

As mentioned before, the children performed better for after than before in these conditions. Coker interpreted the result in terms of a next-event-in-time strategy: the children respond with the next event rather than the past event to every question. Harner explains ease of after in terms of the prospective ordering of events against

the retrospective ordering of events. She suggests that these relational terms are better understood when they are used to order the future with respect to the present. Harner's suggestion of each of prospective ordering may find support in Ames (1946). Ames investigated the development of the sense of time in children's spontaneous speech and question-answer method. She demonstrated young children's conceptual difficulty with retrospective thinking in the following passage (p. 112):

> Not only does the word "tomorrow" come in, in spontaneous verbalization before use of the word "yesterday," but also the child in answer to questions is able to tell what he will do tomorrow before he is able to tell what he did yesterday ... The average child in this group could tell what he would do tomorrow when he was 3 years old, "play" being the most common answer. He could not tell what he had done yesterday until he was 4 years old.

The same tendency is reported in a large scale study of relational opposites acquired by Japanese preschool children (Kokuritsu Kokugo Kenkyujyo, 1980). The study has shown that, in comparison to the terms expressing the future, the responses of the past terms such as yesterday or last year were poor. Ames noted that use of after precedes use of before; and that late precedes early. The prospective ordering seems to correspond to the order-of-mention strategy, but Harner's finding is interesting and suggestive because it would never emerge from the experimental paradigm employed in Clark (1971) and others who focus their attention only upon a series of two events in comprehension study.

Bowerman (1979) once remarked that Clark's claim that before is acquired earlier than after has been "a source of controversy." Despite the efforts of many researchers, the controversy still remains

to the present day. Yet, it cannot be denied that many interesting insights have been gained over the years, which will be useful for future acquisitional research of any linguistic forms.

3.3.2 Sentences expressing a sequential and a simultaneous relation

Developmental studies of both sequential and simultaneous connectives are relatively few in number, compared to those of before/after studies (Clancy et al., 1976; Clark, 1970; Feagans, 1980; Kayra-Stuart, 1980; Keller-Cohen, 1975; Munro & Wales, 1982). In this section, the assumption set up in Chapter Two is evaluated in the light of this empirical research.

In Chapter Two the developmental order of temporal notions is assumed to be in the order/sequence > simultaneous > the sequence of before/after. If linguistic forms develop isomorphic with cognitive development, the developmental order of temporal connectives will be predicted as sequence (e.g., and then) > simultaneous (e.g., when, while) > before/after. This order prediction is first discussed in terms of data compiled from naturalistic observation.

Clancy et al. (1976) and Clark (1970) are the only studies which contain data from naturalistic observation. Another longitudinal connective study by Bloom et al. (1980) does not include before/after in the analysis, probably because these terms have not appeared during the early period of their investigation. As mentioned in the previous chapter, Bloom et al. found that the first connective to emerge is and. It first expressed an additive relation, which subsequently encoded with other meaning relations in the order temporal > causal >

adversative. The notion of temporal relations develops at about the age of 2;4 years. As Bloom et al., however, combined sequential and simultaneous relations together into a category of the temporal, there is no way to tell from their data which notion of these temporal relations emerges earlier. Among other connectives, and then and when appear relatively early. This finding parallels that of Clancy et al., although there is a reported difference regarding the recording method of the first instance of child utterances between the two studies. While Bloom et al. set a criterion productivity in advance, leading to a conservative estimate of acquisitional time, Clancy et al. included the first appearance of a given form in their analysis of the data from four languages (English, Italian, German, and Turkish). Naturally, the appearance of the temporal relation in their data is earlier compared to that in Bloom et al. The sequence appears by the age of two in all languages except in English longitudinal data from Adam (Roger Brown's subject). There is no mention of simultaneity preceding the appearance of when, which initially expresses sequence and, later on, simultaneity in all four languages. The connectives before/after appear late in the final stage of the temporal connectives. Consequently, the prediction of the developmental order of the temporal connectives based upon the corresponding conceptual knowledge is supported by the data in Clancy et al.

E. Clark was the first researcher to have investigated systematically and experimentally the acquisition of sentence constructions of two events related in time. Clark (1970) proposed that the two fundamental time concepts are a simultaneous and a sequential relation of events. She considers that the simultaneous relation precedes the

sequential relation in language development. Clark examined vocabulary records from past studies, in which German and French children first learn to use adverbs referring to the present moment, now, today, etc., and later on start to use adverbs referring to remote time in the past and in the future, e.g., then. It was hypothesized by Clark that such a developmental order of adverbs should be followed in the acquisition of sentence constructions to express events related to time. It should be noted that Clark defines simultaneity in relation to the present. For Clark, simultaneity seems to refer to both "X at the same time to the present" and "X at the same time Y."

Clark (1970) collected spontaneous speech data over six months from children whose average age was 3 years. The data showed that all the children started to use and as a sentence connective, followed by and then and and so. The first pure temporal connective to emerge was when which indicates simultaneity. Other temporal connectives such as before, after, until and while did not appear early enough that claims could be made about their developmental order. Clark argues for the precedence of simultaneity over sequence based on the acquisitional order of when and before/after.

Apart from her argument, Clark's data demonstrates quite a similar developmental order of temporal connectives as observed in Clancy et al. It can be concluded that the naturalistic observation data corroborate the predicted developmental order of temporal connectives, namely: sequence > simultaneous > before/after.

Sentences expressing a simultaneous and a sequential relation have been experimentally investigated using the four tasks of imitation, verbal imitation, comprehension, and production in Keller-Cohen

(1975) and Kayra-Stuart (1980). The results of the imitation task were already mentioned in Chapter One. The scoring methods for the production studies were different from each other, which makes the results difficult to compare. The results of the verbal imitation, and comprehension studies are discussed here.

Connectives which were studied by Keller-Cohen were the following: first/last, and then, before/after, at the same time, and while. In the imitation task, she found no significant difference between first/last; and then and before 1/after 1 (order of mention). Sentences containing these connectives, however, were significantly easier than the other pair of before/after sentences (before 2/after 2), which in turn were easier than sentences containing simultaneous connectives (at the same time and while, responses to which were combined for the analysis). The comprehension task revealed the complexity of these connectives in the order first/last, and then > before 1/after 1 > before 1/after 2 > at the same time; while. The results led Keller-Cohen to conclude that sequence (including before/after) is acquired earlier than simultaneity.

Kayra-Stuart (1980) included temporal terms marking duration in addition to those of sequentiality and simultaneity in her study. Connectives which are relevant to the present discussion are before/after, at the same time, when, and while. Although both when and while mark simultaneity, while implies the simultaneous relation of events over an extended time. Therefore, Kayra-Stuart reported that momentary verbs (e.g., drop, touch) were used for when sentences and durative verbs (e.g., slide, swing) were used to while sentences. Her verbal imitation task has shown that before/after and at the same time are

easier than when and while, whereas in the comprehension task, at the same time was the easiest. There was no marked difference among before/after, when and while. The facility of at the same time in Kayra-Stuart's study is explained in terms of its structure. It conjoins NPs in her study ("Push the red and the green at the same time"), while it conjoins sentences in Keller-Cohen's ("The girl hit the elephant and the boy jumped over the box at the same time"). Although simultaneity was found to be hard in Kayra-Stuart's imitation task, the same result was not obtained in the comprehension task. Since correct responses to all these terms were fairly high (close to 66% at lowest), children might have already known these terms, as Kayra-Stuart noted. The children tested in this study were older (4;3-6;11 in mean ages) than those in Keller-Cohen (2;11-4;11).

The age effect is clearly demonstrated in the results of Feagans (1980). Feagans investigated the comprehension of before/after and while, as well as other temporal connectives with children ranging in age from 3;10 to 7;11. According to her, before is the only connective which the 3-year-olds can act out at better than chance level. By 5 years of age, performances on before/after are above chance levels. At the age of 7, performances are all above chance on before/after and while.

These experimental results indicate that younger children find it hard to process sentences expressing simultaneity in experimental tasks. The only exception is seen in Munro and Wales (1982) who report simultaneity to be easier than sequence. The connectives used in their study were before/after and at the same time as. Other studies, however, did not support the developmental order of temporal

connectives predicted by the development of temporal notions. Sequence, whether expressed by and then or before/after, precedes simultaneity, especially in the case of young children. This discrepancy may be due to an experimental demand which requires children to process a sentence expressing two different actions of two different subjects at the same time, although some researchers claim that they carefully arrange materials so that children can handle them easily (Feagans and Keller-Cohen). Accordingly, it is necessary to evaluate the complexity of these temporal connectives in the experimental task in which the manipulation requirements are kept to a minimum.

3.3.3 Local cues

In his recent paper Slobin (1982) presented his results of cross-linguistic research in which the acquisition of four languages, English, Italian, Serbo-Croatian and Turkish, was experimentally investigated. Slobin's interest, which has continued from his earlier work (1973), was in finding out which kinds of linguistic structures facilitate or hinder the child's discovery process in his mapping linguistic forms onto cognitive notions. The findings of the cross-linguistic survey led Slobin to propose 'local cues.' Their presence signals underlying meaning of the cues which occur at localized points in sentences. The local cues cited are grammatical particles expressing such notions as causation, negation and aspect, in addition to grammatical inflections.

Slobin argues for the role of grammatical devices like inflections by stating that they are often generally ignored, with a priority instead given to the use of word order in sentence processing. Devices like grammatical inflections are efficient because they allow the child to process sentences without taking the entire sentence into account. The notion of local cues is an extension of one of Slobin's operating principles (1973): underlying semantic notions should be marked overtly and clearly. The notion ("surface cues") has been well researched in psycholinguistics as Slobin pointed out.

Slobin (1982) conducted four language comprehension tests, one of which dealt with before/after. The results indicate that Turkish children understood before/after sentences at a much younger age than the children of other languages (English, Italian and Serbo-Croatian). Slobin explains the results in terms of local cues. In Turkish, verbs are nominalized in the subordinate clause of before/after sentences. Since the event referred to in the subordinate clauses of before sentences has not occurred at the time of the main clause event, the verb form in the subordinate clause expresses a potential rather than realized action, followed by a negative particle (Slobin, 1982, p. 143), as in (10).

(10) Köpek atla-ma-clan önce deve kossun.
dog jump-negative-ablative before camel should run

Before the dog jumps the camel runs.

In the after clause, on the other hand, the verb form indicates a realized action. Slobin suggests that the negative particle is a strong local cue. Once the child realizes in the comprehension task that he is required to act out two events, the negative particle

functions to clarify the sequential relations. The children's better performances on before sentences than on after sentences clearly show that they interpreted the negative particle as an indication that one of the actions does not occur.

A Japanese before clause does not contain a negative particle, but otherwise constructions of before/after sentences parallel those of Turkish. While arguing for the negative particle, Slobin does not think that the children in the age range tested have mastered the aspectual distinction between the two nominalized verb forms: potential versus realized. I want to argue, however, that this is an experimental question. Considering that the performances of Turkish children in the age group ranged from 4;0 to 4;4 are almost 100% correct (those of English counterparts are 60%), I suspect that Turkish children use aspect as a clue in sentence processing of after as well as before sentences.

As for Japanese before/after sentences, an instance of before sentences has already been recorded in 3-year-old Japanese boy's data (Kokuritsu Kokugo Kenkyujyo, 1981). I suggest that aspect in before/after clauses functions as a strong local cue in the acquisition of these sentence constructions. The resolution of this issue is one of the objectives of the present study as discussed in the next section. The results of this study should shed light upon the development of aspect in the child's language acquisition since there are few studies of aspect reported in the development of complex sentences in the literature. The following table shows the local cues in Japanese temporal clauses which are tested in this study.

Table 3.1

The Local Cues in Japanese Temporal Clauses

Verb Phrases	Connectives
V-ru	mae
V-ta	ato
V-ru/V-ta/V-te iru/V-te ita	toki
V-ru/V-te iru/V-te ita	aida

3.3.4 Developmental studies of Japanese temporal connectives

The acquisition of Japanese temporal connectives has not systematically been studied in the past, but the appearance of these terms in children's language data has been noted in the naturalistic observations of Okubo (1967) and Kokuritsu Kokugo Kenkyuujyo (1981).[1] Production data by preschool children were found in Okubo (1973) and Takahashi (1975). There are not many experimentally manipulated studies designed to investigate the development of these terms, but the acquisition of mae/ato 'before/after' sentences was reported in Kamio (1976), and Suzuki (1972) as cited in Sasanuma and Kamio (1976). In what follows, the research results will be discussed and areas which need further studies will be pointed out.

Okubo (1967) followed the course of language development in her child from the age of 1 to 6. She noted the first appearance of mae/ato 'before/after' between the ages of 2 and 2;5. The connective sorekara 'then' also appeared around the same time. Since she did not

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[1]The National Language Research Institute. The abbreviation, KKK, will be used hereafter.

specify the function of mae/ato in the data, it is not known whether these terms were used adverbially as observed in zutto mae 'a long time ago' and ato de 'later,' or used as conjunctions. An instance of conjunctive use of mae, however, is found in another three-year-old boy's (T's) language data at the time of his birthday (KKK, 1981). Therefore, it is possible for mae/ato to be used as connectives at the age of 3 or earlier.

As mentioned above, the connective sorekara appeared at about the same time as mae/ato in Okubo (1967). Sorekara explicitly expresses a sequential relation of clauses combined with the verb-te form: V-te, sorekara 'and then.' According to Okubo (1973), younger children used the term sorekara more often as a phrasal coordination or as an interjection rather than as a connective. Accordingly, the record of its appearance does not tell us anything about the acquisition of the V-te, sorekara. In addition, Okubo (1967) reported that there were not many cases in which the V-te form was used to connect clauses up to the age 3, although the form itself appeared at 1;8 and had often been used to express other functions. The aforementioned 3-year-old T's data included V-te, sorekara as well, which suggests the acquisition of this form before the age 3.

Turning to the acquisition of connectives expressing a simultaneous relation, Okubo (1967) placed the first appearance of toki 'when' at 2;2:

(11) Mata kureyon nakunatta toki katte ne.
again crayon are gone buy

When the crayons are gone (used up) again, please buy them (for me).

Toki like English when, relates clauses sequentially as well as simultaneously. This relation is defined by factors including the kinds of verbs, the forms of verbs and the compatibility of events in time. As to the acquisition of when, Clancy et al. (1976) reported that when initially expresses sequence and, later on, simultaneity in their four language samples from English, Italian, German and Turkish. They commented on the semantic notion of early when sentences as follows: 'In early examples, the child seems to be presenting a state or event in the "when" clause which is a precondition for some action to be taken' (p. 76). It is interesting to note that the sentence example quoted from Okubo (1967) fits exactly into this description. The observation of Clancy et al. of a sequence function prior to a simultaneity one has support from Japanese data. Unfortunately, Okubo (1976) did not include other toki sentences in her data which might have shown the time of acquisition of simultaneous toki. A few toki sentences can be observed in T's diary, but none of them happened to express simultaneity.

The connective -nagara 'while' developed late at 3;8 in Okubo (1976), the acquisition of which was contrasted to a much earlier acquisition of the same term by a boy at 2;5. In T's data recorded on his third birthday -nagara can be found as follows:

(12) Shutto mijyu o kake-nagara kita jyo.
water sprinkling came

(Something) came sprinkling water.

Another connective, aida 'while,' was not mentioned in Okubo (1967) nor was it found in T's data. Consequently, it is not possible to determine when the term aida would be acquired.

In summary, there were inadequate naturalistic observation data to propose any developmental order of these temporal terms, but it was found that V-te, sorekara, mae, -nagara and toki may appear before the age 3. The first appearance of toki marking sequence occurs at 2;2.

In contrast to the early naturalistic observation data of a few children, the results found in Okubo (1973) and Takahashi (1975) were both based on large-scale data collected by Okubo from dialogues with preschool children. The dialogues covered topics such as family life, activities at the kindergarten, favorite books and TV programs. Three hundred and five children were interviewed: sixty-nine in 3;3-4;4, one hundred and twenty-one in 4;1-5;6 and one hundred and fifteen in 5;5-6;6.

The results reported in Takahashi (1975) are as follows: (1) the connectives mae/ato were found in the two older groups, but not even a single instance of these connectives was found in the younger group of 3-year-olds, (2) the same applies to aida, and (3) the children in all groups seemed to have mastered the use of toki and -nagara. Takahashi did not include the V-te, sorekara form for analysis. According to Okubo (1973), the V-te forms were used profusely among the children of the two younger groups to connect sentences. The V-te serves as an all-purpose connective marking temporal sequence, reason, purpose, place, manner, method, means, coordination, quotation, etc. She pointed out that in most of these cases temporal sequence is a precondition for the connection of the two clauses. The V-te, sorekara was also used, although not quite as often by the children in the younger group.

The developmental pattern observed in the production data of preschool children bear a close resemblance to those suggested by Clancy et al. (1978) based on conceptual development of temporal notions namely: sequence > simultaneity > before/after. On the other hand, the early appearance of mae in T's data from his third birthday leads us to speculate that aspect in mae clauses may function as a local cue and, accordingly, may help to bring forth the early acquisition of mae/ato clauses. As mentioned before, the function of a local cue is one of the major objectives of this study.

Finally, the experimental results of Kamio (1976) and Suzuki (1972) will be briefly described. Kamio had thirty children ranging from 3;7 to 5;0 in age imitate the following sentences:

(13) Usagi o osite kudasai; sono atode sika o nadete kudasai.
rabbit push please that after deer stroke

Push a rabbit; after that stroke a deer.

(14) Kirin o taosite kudasai; sono mae ni usagi o hippatte
giraffe knock down before pull

kudasai.

Knock down a giraffe; before that pull a rabbit.

(15) Usagi o motiageta atode, zoo o nadete kudasai.
held up elephant

After (you) hold up a rabbit, stroke an elephant.

(16) Sika o naderu mae ni, zoo o osite kudasai.

Before (you) stroke a deer, push an elephant.

The results showed that sentences (15) and (16) were easier than sentences (13) and (14). Among the four sentences, sentence (16) was found to be the easiest. In addition, the analysis of errors had revealed that the children were more likely to repeat ato sentences as

mae sentences. It appeared that mae sentences were easier to imitate for the preschool children investigated.

Suzuki (1972), cited in Sasanuma and Kamio (1976), found in an act-out task with children aged 2;9 to 6;9 that the percent correct for ato sentences reached 100 percent at the age of 4;0-4;5 years. The performance then dropped off a little, but came back again to a perfect score at the age of 6;6. In contrast to ato, mae sentences were harder, with the error rate highest for 3;0 to 3;5-year-olds. Despite the fact that the error rate had decreased over the years, it never dropped to zero even for the oldest children of 6;9. Sasanuma and Kamio interpreted the results as due to the order-of-mention strategy. Contrary to English sentences, the event order corresponds to the order of occurrence of events in ato sentences in Japanese, which may explain for the ease with which ato sentences are performed in the act-out task.

The experiments described above offered conflicting results, but there was clear indication that the results might be task dependent: in the imitation task carried out by Kamio mae was easier to imitate, whereas ato was found easier in Suzuki's act-out task.

In this section studies concerned with Japanese connectives were briefly reviewed. These studies came mainly from three sources: (1) naturalistic observation data, (2) production data based on dialogues with preschool children, and (3) experimental studies of mae/ato.

There were not enough data from naturalistic observation to propose any developmental order of the temporal terms, but it was found that the V-te, sorekara, mae, -nagara and toki may appear before the

age of 3. The production data of preschool children, on the other hand, appear to suggest that a developmental order of Japanese temporal clauses can be predicted based on the conceptual development of temporal notions. The early appearance of mae in T's data, however, leads one to speculate that aspect in mae clauses may function as a local cue, thereby bringing forth the early acquisition of mae/ato clauses. The results from experimental studies are inconclusive as to the ease for mae/ato. In addition, these studies only investigated the processing of mae/ato. Thus, a developmental study including other temporal connectives is needed. The study should be devised in such a way that the children's sentence processing should not be biased by a particular response tendency such as an order-of-mention strategy which is often observed in experimental tasks. Taking these points into consideration, three hypotheses were formulated, each of which will be described in the following section.

3.4 Hypotheses

The aim of the present study is to provide additional evidence from the Japanese language concerning the development of temporal connectives expressing a sequential and a simultaneous relation. The following hypotheses are formulated to test the development of temporal connectives in experimental tasks.

Hypothesis 1: The developmental order of temporal connectives is isomorphic with that of the development/emergence of temporal notions.

Hypothesis 1 is formulated to test whether the developmental sequence of temporal connectives in the present study can be predicted by the developmental order of the corresponding notions. The hypothesis predicts that the developmental order of Japanese connectives is in the order sequence V-te, sorekara 'and then' > simultaneity toki 'when,' and -nagara/aida 'while' > mae/ato 'before/after.' Therefore, in the following examples, the developmental order is 1 > 2, 3, 4, 5, 6 > 7, 8. In Japanese, subordinate clauses precede the main clause, so that the clausal order in the following sentences is fixed.

1. John wa gohan o tabete, sorekara terebi o mita.
   John ate a meal, and then (he) watched TV.

2. John wa gohan o taberu toki, terebi o mita.
   When John ate a meal, (he) watched TV.

3. John wa gohan o tabeta toki, terebi o mita.
   When John had eaten a meal, (he) watched TV.

4. John wa gohan o tabe-nagara terebi o mita.
   While eating a meal, John watched TV.

5. John wa gohan o tabete iru aida, terebi o mita.
   While John was eating a meal, (he) watched TV.

6. John wa gohan o tabete iru aida, terebi o mite ita.
   While John was eating a meal, (he) was watching TV.

7. John wa gohan o taberu mae ni, terebi o mita.
   Before John ate a meal, (he) watched TV.

8. John wa gohan o tabeta ato, terebi o mita.
   After John ate a meal, (he) watched TV.

Hypothesis 2: Local cues, the V-ru/-ta forms, in mae/ato 'before/after' clauses facilitate the development of these sentences.

In contrast to Hypothesis 1, Hypothesis 2 predicts the developmental precedence of temporal connectives mae/ato 'before/after' to toki/aida 'when/while.' The hypothesis is formulated to test the role of local cues in the acquisition of Japanese temporal connectives. The local cues exist in the simultaneous clauses of toki 'when' and aida 'while,' but they are predicted not to function as effectively as processing cues in these sentences as in mae/ato 'before/after' sentences. It was previously observed that the Verb-ta form signifies the completive aspect, and the V-ru forms, the incompletive aspect. Since the event in the mae 'before' clause always follows that in the main clause, the verb phrases in the embedded clause of mae should be in the V-ru form regardless of the tense of the main clause. The verbs in the ato 'after' clauses, on the other hand, should be in the V-ta form since the event in these clauses occurs prior to that in the main clause. In other words, verb forms which co-occur with mae/ ato connectives are always in the same and regular forms. In contrast, a unique co-occurrence of verb forms and connectives does not occur in toki and aida clauses. Since the child is known to acquire regular forms first (Slobin, 1973), mae/ato sentences are predicted to develop earlier than toki/aida sentences. Hypothesis 2 predicts that the development of mae/ato and toki/aida sentences above would be in the order 7, 8 > 2, 3, 5, 6.

Hypothesis 3: Comprehension of the temporal connectives is better in a natural, meaningful condition than in an experimental condition in which arbitrary sentences are used to test the temporal connectives.

The experiment in the present study is conducted in both an experimental and a more natural, meaningful condition, and the results are compared to each other. The experimental research of temporal connectives expressing both a sequential and a simultaneous relation has all been conducted using arbitrary sentences. The results are different from those obtained in the naturalistic observation studies. This difference may be due to the demand of the experimental tasks, in which children are required to manipulate toys in accordance with arbitrary sentences. The acquisition of these terms should be investigated in a more natural, meaningful situation where the manipulation demand is kept to a minimum. It has been reported that a logical or meaningful sequence facilitates the comprehension of before/after sentences (French & Brown, 1977; Kavanaugh, 1979). Consequently, performances of comprehension of the temporal connectives in the natural, meaningful condition are predicted to be superior to those in the experimental condition.

Recent investigations of memory have revealed that preschoolers have knowledge about routine events or repeated familiar experiences, and that they utilize this knowledge when the verbal or situational context calls for it (McCartney & Nelson, 1981), just like adults do when following a "script" (Shank and Abelson, 1977). McCartney and Nelson made children, ranging in age from 5;3 to 8;6, listen to a story about events which occur on a typical evening, and let them recall it later. It was found that the younger children were able to sequence the events properly with few idiosyncratic interferences.

McCartney and Nelson concluded that "children have an ordered knowledge representation with which to understand a story about a

typical evening in the life of a young child" (p. 65). Although the researcher's emphasis is on the ordered knowledge of the child's daily life, it can be assumed that the child has knowledge about familiar, routine events which occur simultaneously.

In the present study, 3 sets of 4 event series about the daily life of a young child are employed to provide for a natural, meaningful condition (Appendix A). In order to test Hypothesis 3, performances of temporal connectives in this condition are compared to those in the experimental condition in which another story task and act-out tasks are employed.

4. THE EXPERIMENTS

4.1 Introduction

This chapter is devoted to the description of the experiments which were conducted to investigate the development of Japanese temporal connectives expressing a sequential and a simultaneous relation. The three hypotheses to be tested are the following:

Hypothesis 1: The developmental order of temporal connectives is isomorphic with that of the development/emergence of temporal notions.

Hypothesis 2: Local cues, the V-ru/-ta forms, in mae ni/ato 'before/after' clauses facilitate the development of these sentences.

Hypothesis 3: Comprehension of the temporal connectives is better in a natural, meaningful condition than in an experimental condition in which arbitrary sentences are used to test the temporal connectives.

Three sets of experiments were carried out; the primary experiments dealing with 3- to 5-year-old children, the second with grade 5 and 6 children and the third with adults. The designs of the respective experiments are described below.

4.2 Experiment I: The Primary Study

4.2.1 Subjects

The subjects were monolingual speakers of Japanese, all residing in Tokyo, Japan. The ninety-six children were divided into three age groups in equal numbers: 3;4 to 4;2 (mean age, 3;10), 4;3 to 5;2 (mean age, 4;9), and 5;3 to 6;2 (mean age, 5;9). The children, who attended either a private kindergarten or a nursery school, were tested individually.

4.2.2 Materials

4.2.2.1 The pilot study

Preceding the primary study, a pilot study was carried out with twenty-four Japanese-speaking children, ages 3, 4 and 5 years. Two tasks were employed: story comprehension and act-out.

The story task required the children to answer questions regarding the temporal relation between events in stories. There were four frames of pictures for each of the three sets of events about the daily life of a young child. There were two versions of the stories: a boy version and a girl version. The former was shown to boys and the latter to girls. There was no difference in the stories between these versions except for the figure of the child. The three stories were about; (1) a series of events in the morning (getting up, having breakfast, brushing teeth, going to kindergarten); (2) a series of events after school (coming back from kindergarten, washing hands, eating a snack, playing with toys); (3) a series of events in the evening (watching TV, eating supper, taking a bath, going to bed) (Appendix B). The experimenter asked the child to describe each action depicted in each frame, and then checked the child's knowledge about a series of

events. When all four frames were placed in a sequential order, a question was asked with each temporal word; e.g., "Otoko no ko wa gohan o taberu mae ni, nani o simasuka?" "What does the boy do before (he) eats breakfast?" Each of the stories has seven questions, one for each of the temporal words, as illustrated by the following:

(1) Kono ko wa gohan o tabete, sorekara nani o simasuka.
This child has a meal, and then what does he do?

(2) Kono ko wa gohan o tabe-nagara nani o simasuka.
What does this child do while having a meal?

(3) Kono ko wa gohan o tabeta ato, nani o simasuka.
What does this child do after he has a meal?

(4) Kono ko wa gohan o taberu mae ni, nani o simasuka.
What does this child do before he has a meal?

(5) Kono ko wa hoikuen e iku toki, nan to iimasuka.
What does this child say when he goes to daycare?

(6) Kono ko wa hoikuen e itta toki, nan to iimasuka.
What does this child say when he has arrived at daycare?

(7) Kono ko wa gohan o tabete iru aida, nani o simasuka.
What does this child do while he is having a meal?

Even the youngest group of children could arrange a series of familiar events in a sequential order, and could answer questions concerning the temporal relation of events. The percentage correct for this task was 63.1% for 3-year-olds, 64.9% for 4-year-olds and 86.9% for 5-year-olds.

For the act-out task the children were required to act out with toys seven types of sentences read to them. Examples of each of these types are shown below.

(8) Otoko no ko ga tora o tataite, sorekara onna no ko ga inu o tobikoeta.
The boy hit the tiger and then the girl jumped over the dog.

(9) Otoko no ko ga tora o tataita ato, onna no ko ga inu o tobikoeta.
After the boy hit the tiger, the girl jumped over the dog.

(10) Otoko no ko ga tora o tataku mae ni, onna no ko ga inu o tobikoeta.
Before the boy hit the tiger, the girl jumped over the dog.

(11) Otoko no ko ga tora o tataku toki, onna no ko ga inu o tobikoeta.
When the boy hit the tiger, the girl jumped over the dog.

(12) Otoko no ko ga tora o tataita toki, onna no ko ga inu o tobikoeta.
When the boy had hit the tiger, the girl jumped over the dog.

(13) Otoko no ko ga tora o tataite iru aida, onna no ko ga inu o tobikoeta.
While the boy was hitting the tiger, the girl jumped over the dog.

(14) Otoko no ko ga tora o tataite iru aida, onna no ko ga inu o tobikoete ita.
While the boy was hitting the tiger, the girl was jumping over the dog.

Where the clauses in a sentence have alternate agents, -nagara sentences cannot be used. Sentence (14) was included here for the purpose of examining the children's comprehension of the durative aspect expressed by V-te iru form in the main clause of the aida 'while' sentences.

The selection of the verb phrases employed in the sentences above was made by taking into consideration both the verb phrase type and the durative aspect. It was previously discussed that the temporal relation of 'toki 'when' sentences was defined by the types of the verb phrases used in the main and embedded clauses. In the story task, achievement VPs were used in both clauses in the toki sentences with the exception of an accomplishment VP in one of the embedded clauses.

For the act-out task, a specific type of verb (called "momentary verbs" in English) was chosen since the duration of these verbs could be measured easily (cf. Feagans, 1980). They were tataku 'hit,' tobikoeru 'jump over,' osu 'push,' and naderu 'stroke.' Feagan

noted that the probability of the number of the times these verbs are acted out is different from each other. For example, for the following sentences quoted from Feagans (1980, p. 46), the VP in (a) is predicted to be acted out only once while the one in (b) is most likely to be acted out more than once.

(15) a. The boy jumped the fence.
b. The boy beat the drum.

When these VPs are placed in the progressive form such as in (16a), however, the probability of their being acted out a greater number of times invariably increases over that in the past tense.

(16) a. The boy has been jumping the fence.
b. The boy has been beating the drum.

The same change of the status of the VPs from the V-ta form can be obtained in Japanese verbs of V-te iru form expressing the progressive aspect. Such differential status of V-ta and V-te iru forms should affect the processing of aida 'while' sentences in (13) and (14), since the V-te iru in the main clause in (14) expresses the total inclusion of its state within the state defined by the aida clause, in comparison to the undefined, partial inclusion denoted by the punctual verb. Thus, for sentence (13), it is expected in an act-out task that the girl doll jumps over the horse just once while the boy doll is hitting the tiger. On the other hand, in (14) the action of the girl jumping over the dog occurs repeatedly throughout with the action of the boy hitting the tiger.

Two sets of the seven types of sentence above were presented to the children to act out in the pilot study. In addition, the children were given four pairs of sentences such as (17) to test whether they can distinguish the differential status of these forms in the verb duration task.

(17) Otoko no ko ga tora o { tataita. / tataite ita. }

The boy { hit / was hitting } the tiger.

Half of the eight sentences included the V-ta form of the verbs listed above and the other half included the V-te iru form.

The result of the pilot study showed that despite the fact that the main effect of sentence type was significant, no difference was found between sentence types of (13) and (14). There was also no significant difference on the duration scores of the progressive and the past simple sentences in the verb duration task. As a result, sentence type (14) was not employed in the primary study.

4.2.2.2 The primary study

Two tasks, act-out and stories, were conducted in the primary study, each of which had two subtasks. These four tasks will be called story tasks 1 and 2, and act-out tasks 1 and 2 hereafter.

Story Task 1 was exactly the same as the one administered in the pilot study. Three sets of seven sentence types were used (Appendix A).

The same format was adopted in story task 2 as was used in task 1, which also had three stories (Appendix B). Each story consisted of four frames depicting a series of events. There was no difference between pictures shown to boys and girls in this task. The same picture sets were employed for both boys and girls.

As story task 2 was designed to test hypothesis 3, the event series were not as logical nor as predictable as in the event series about daily life. For example, in one series the action of a child's raising hands preceded the action of the child jumping over a box,

followed by the slapping of his knees. This task was intended to test Hypothesis 3 by presenting an arbitrary sequence of events, in contrast to story task 1 of the event series about daily life. Again, all the VPs in the toki clauses were achievement VPs except one VP of accomplishment. Three sets of stimulus sentences of the seven types are found in Appendix A.

Act-out tasks 1 and 2 were both act-out tasks in which children were requested to manipulate toys. The sentences employed in act-out task 1 paralleled those in story task 2 in terms of event relations expressed by the main and embedded clauses, so that the comparison of performances could be made across tasks. Events encoded in the embedded clauses were similar to each other except that the subject in the sentences was a rabbit in act-out task 1 whereas it was a boy or a girl in story task 2. Where the main clauses in the story task 2 were questions, the answers to them should correspond to the statements encoded in the main clauses in act-out task 1. Two sets of seven stimulus sentences were constructed and presented to the children.

Sentences used in act-out task 2 were similar to those in the pilot study. The sentences were different from those employed in act-out task 1 with regard to clausal subjects. While the clauses had different subjects in sentences used in this task, the clausal subject in sentences in task 1 was one and the same. This task was modeled after those found in English experimental studies such as Feagans (1980) so as to make the results comparable. As already pointed out, one type of the aida sentence was not used. In addition, the verb osu 'push' was replaced by nameru 'lick' because of the difficulty in the

handling of the toys by the children. A few changes of combination of the VPs were made in two sets of six sentences.

All the stimulus sentences used in the four tasks are found in Appendix A. The order of sentence presentation was randomized in each set.

4.2.2.3 Relative clauses

The tense categories of Japanese have two subcategories: past and non-past, of which the past is expressed by the V-ta form and the non-past by the V-ru form. In addition to marking the tense, these two forms also denote aspect. The V-ru form indicates incompletive and the V-ta form completive.

The -ta is used in main clauses or in simple sentences when the event referred to occurred earlier than the speech time; otherwise, the -ru is used. The use of these forms in the subordinate clause depends on the relative temporal order of the event in this clause to that in the main clause: if the former is earlier than the latter, the -ta is used and if later, the -ru is used (Ota, 1982).

Due to the dual functions of the verb in simple sentences, the problem of ambiguity arises regarding its function. Note the following sentences quoted from Nakau (1980, p. 109).

(18) a. Ano hon wa yonda yo.
that book read
b. I read that book (yesterday).
c. I have read that book (already).

According to Nakau, sentence (18a) may correspond to (18b) or (18c) in English. The fact that the V-ta form is ambivalent in reference to the tense and aspect can be exemplified even more clearly when affirmative answers to the following questions are compared with negative answers (Nakau, p. 110).

(19) a. Ano hon wa kinoo yonda?
Did (you) read that book yesterday?
b. (Un, ano hon wa kinoo) yonda yo. (=18a)
(Yes, I) read (that book yesterday.)
c. (Iya, ano hon wa kinoo) yomanakatta.
(No, I) did not read (that book yesterday.)

(20) a. Ano hon wa moo yonda?
Have you read that book already?
b. (Un, ano hon wa moo sudeni) yonda yo. (=18a)
(Yes, I) have read (that book already.)
c. (Iya, ano hon wa mada) yonde inai.
(No, I) have not read (that book yet.)

Nakau states that although the same -ta appears in (18b) and (20b), its function in each sentence is different. When we look at respective questions, the verb yonda expresses the past tense in (19a) because it occurs with a deictic adverb kinoo 'yesterday'. On the other hand, in (20a) it expresses the completive aspect because it occurs with moo 'already' which marks the completion. Such differential functions of yonda are reflected in negative answers, as well: in (19c) the verbal phrase has the negative past tense marker -nakatta, while in (20c) it has the negative -te inai form designating the present state.[1]

Such functional ambiguity of the verb does not come up in the embedded clause, however, particularly when the verb in the embedded clause is an action verb. The same temporal relation observed in toki 'when' clauses holds in other embedded clauses including relative clauses; that is, the V-ta in the relative clause indicates that the event in the relative clause precedes that in the main clause, and the V-ru denotes a reversed relation of them, as shown in the following example.

---

[1]The same observation is made by Teramura (1979).

(21) a. Yomu hon o katta.
(I) bought the book that I was going to read.
b. Yonda hon o katta.
(I) bought the book that I had read.

In (21a) the action of kau 'buy' precedes the action of yomu 'read': in (21b) the opposite is true. The temporal contrast of the -ru and -ta is observed in the following sentence, as well.

(22) a. Hon o yomu hito wa Sumisu san da.
book read person Smith Mr. is.
The person who will read a book is Mr. Smith.
b. Hon o yonda hito wa Sumisu san da.
The person who has read a book is Mr. Smith.

The problem of ambiguity discussed above, however, arises again in this pair: it is not clear whether yomu marks the future tense or the incompletive aspect.

Kuno (1973) makes an interesting comment on this type of sentence based on Josephs' observation (1973). He states that "if the relative clause modifies the subject of an adjectival or copulative predicate, the past tense must be used in the relative clause if it refers to past tense"[2] (p. 264). The following example is quoted from Josephs (p. 119).

(23) a. Taroo ga { yonde ita / *yonde iru } hon wa Shakespeare datta.
The book Taroo was reading was Shakespeare.

b. Kare ga { sanpo sasete ita / *sanpo sasete iru } inu wa tiisakatta.
The dog which he was walking was small.

Kuno explains the phenomena as due to the function of the VP in the relative clause. Consider the following pair of the sentences.

---

[2]Kuno says that the rule applies only when the VP marks 'a non-habitual, nonfuture state form' of the -te iru.

(24) a. Taroo ga yonde ita hon wa Shakespeare da.
The book which Taroo was reading is Shakespeare.

b. Kare ga sanpo sasete ita inu wa tiisai.
The dog which he was walking is small.

The VP in the main clause now changes into the present tense. Despite the change, the meaning of the sentences does not change substantially from (23). Kuno suggests based on the foregoing observation that the VP in the relative clause defines the tense of the sentence.

> . . . in (11) and (12)[3] the verb in the relative clause is, semantically speaking, the principal verb of the sentence and thus determines the time referred to by the sentence, and that the copula or adjective in the main clause can optionally take the past tense form in tense agreement (p. 265).

Kuno's suggestion may explain the fact that the sentence pair of (22) is ambiguous in reference to the tense and aspect. As discussed above, the simple sentence is always ambiguous without a temporal adverb to clarify it: e.g. "Taroo ga hon o yonda" 'Taroo (had) read a book.'

Next, consider the following pair:

(25) a. Hon o yomu hito wa Sumisu san datta.
The person who was about to read a book was Mr. Smith.

b. Hon o yonda hito wa Sumisu san datta.
The person who had read a book was Mr. Smith.

While (25b) does not differ much from (22b), the meaning of sentence (25a) changes considerably from that of (22a): the verb yomu in (22a) may represent an imminent action and that in (25a) represents an unrealized action which would never occur.

These subtle differential meanings of the V-ru forms can be expected to develop slowly in the child's language acquisition, because

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[3](11) and (12) correspond to (23) and (24).

of subtle semantic differences with no clear semantic markers. In the present study, only sentence pairs such as the following were given to the children to investigate whether they could process the V-ru and V-ta forms in the relative clause.

(26) Hako o { tobikoeru / tobikoeta } ko wa dono ko desu ka.
Which child is the one who { will jump over / has jumped over } the box?

Six VPs used were hako o tobikoeru 'jump over the box,' suberidai ni noboru 'climb up the slide,' suberidai o suberu 'slide down the slide,' jitensha ni noru 'ride the bicycle,' sunaba ni hairu 'go into the sandbox,' and aisu kuriimu o kau 'buy the ice cream.' All the sentence pairs are found in Appendix A.

4.2.3 Procedures

As explained above, the story tasks required the children to answer questions regarding the temporal relation between events in stories depicted on the four frames of pictures. The two tasks differed, however, in one point; while the order of events was decided by the children in the task 1, in the task 2 it was provided by the experimenter.

In both tasks the experimenter asked the child to describe each action depicted on a frame, and then checked the children's knowledge about a series of events before starting the experiment by using a connective sosite 'and.' In each subtask of the story tasks the presentation of the three sets of event was randomized. Each child was tested individually, and all testing was recorded for the analysis on a Sony cassette recorder (TC-1000B).

In act-out tasks 1 and 2 a practice session was carried out preceding each task in which subjects were asked to identify toy figures and to act out simple sentences consisting of the toys and action verbs which were included in stimulus sentences. The sentences were read twice. When a subject failed to respond to a sentence, it was repeated once at the end of the session. The subjects' responses were recorded on the response sheet.

The present experimental procedure in the relative clause task followed the one adopted in Harner's (1976) in which she investigated children's comprehension of before/after and the verb tense. Five different sets of toys were used: (1) two dolls and a box, (2) two dolls and a slide, (3) two dolls and a sandbox, (4) two dolls and two bicycles, (5) two dolls and an ice cream man with an ice cream cart. The toys were so arranged that an action performed by one doll represented the termination of an action, while the onset of an action was represented by the other doll which was positioned to the starting point of the action.

The experimenter first asked a child to identify the toys, and then she said that she was going to play with the toys. She told the child to show her which one she was talking about, since she was going to ask him some questions about them. The child was told to watch the toys while one doll was moved through the action and the other doll was moved to the starting point of the action. The experimenter then asked; e.g. "Hako o tobikoeta ko wa dono ko desu ka?" 'Which child is the one who jumped over the box?' Following the question, the child was instructed to point to the doll which he thought satisfied the description.

4.3 Experiment II: The Data of Grade 5 and 6 Children

4.3.1 Motivation

The results obtained from the pilot study and the main study have revealed that 3- to 5-year-old children could not act out certain types of sentences: the percentage correct for the relative clauses of V-ru form was low in the relative clause task, and the children could not distinguish V-te ita sentences from V-ta sentences in the verb-duration task conducted in the pilot study.

The experiments were carried out to investigate whether grade 5 and 6 children could process the above types of sentences properly. The three tasks were conducted with ten children from each grade: they were the tasks of the relative clauses and the verb duration, and act-out task 2. The last task was included here because it was found to be the most difficult of the four tasks.

4.3.2 Subjects and design

The subjects were twenty monolingual speakers of Japanese: ten in each grade. The materials and procedures were the same as those found in the pilot study and in the main experiments.

4.4 Experiment III: Normative Data

4.4.1 Motivation

The following experiments were undertaken to provide normative adult data with reference to processing of the temporal clauses. Some temporal sentences appear to be difficult even for grade 5 and 6 children: such structures, accordingly, are predicted to take a long time to be acquired. It is assumed in studies such as this that the children will eventually attain adult competence. In reality, however,

the literature has no experimental data as to how adults process the temporal clauses contained in arbitrary sentences. Because of this, the present experiments attempt to provide normative data from Japanese-speaking adults. The results of the adults' data will be discussed when necessary.

4.4.2 Subjects and design

Ten linguistically naive Japanese-speaking adults served as subjects for story task 1, act-out tasks 1 and 2, and the verb duration experiments. The materials and procedures were followed exactly in the same way as those in the children's experiments.

4.5 Summary

In this chapter the designs of experiments were described. The primary study consists of four main tasks: story tasks 1 and 2 and act-out tasks 1 and 2. In addition, the relative clause task was conducted. For the purpose of collecting normative data, grade 5 and 6 children and adults participated in the experiments. A table of the experimental design is presented on the next page. The results are reported in the next chapter.

Table 4.1 Experimental Design

Experiment	Subject	Task					
		Story task 1	Story task 2	Act-out task 1	Act-out task 2	Relative clauses	Duration
Experiment I	Preschool children (3 to 5 years)	*	*	*	*	*	
Experiment II	Grade 5 and 6 children				*	*	*
Experiment III	Adults		*	*	*		*

(* mark indicates that the task was conducted for study)

5. RESULTS AND DISCUSSION

5.1 Introduction

Statistical tests were conducted to evaluate the experimental data. In this chapter the results of the statistical tests are first described. Secondly, the three hypotheses are evaluated in terms of the data. It is suggested that factors other than conceptual notions may be in effect for the acquisition of Japanese temporal clauses. Consequently, the function of local cues will be examined in detail, followed by a discussion of the differential results of the two major tasks: the story tasks and act-out tasks.

5.2 Results

5.2.1 Experiment I: The primary study

Statistical tests were conducted to evaluate the data of group scores obtained from each age group. The results of the four main tasks are first discussed.

A two way analysis of variance was performed to investigate the effects of age and sentence type for each task. Subjects were divided in three age groups ranging in age from 3 to 5 years. The seven sentence types were included in three tasks: -nagara 'while,' V-te, sorekara 'and then,' ato 'after,' mae 'before,' aida 'while,' V-ta toki 'when' and V-ru toki 'when.' As explained in the previous chapter, -nagara 'while' was not used in act-out task 2; accordingly, the data of six sentence types were analyzed. The results of the ANOVA are found in Table 5.1 through 5.4. In all four tasks, each main effect

Table 5.1 Analysis of Variance for Story Task 1

	SOURCE	ERROR TERM	SUM OF SQUARES	D.F.	MEAN SQUARE	F
1	MEAN	r(as)	37595.57	1	37595.5714	1341.18
2	ages	r(as)	763.52	2	381.7619	13.62**
3	sentence	r(as)	720.54	6	120.0899	4.28**
4	as	r(as)	102.03	12	8.5026	0.30
5	r(as)		1177.33	42	28.0317	

Table 5.2 Analysis of Variance for Story Task 2

	SOURCE	ERROR TERM	SUM OF SQUARES	D.F.	MEAN SQUARE	F
1	MEAN	r(as)	40533.397	1	40533.3968	5364.71
2	ages	r(as)	697.270	2	348.6349	46.14**
3	sentence	r(as)	607.492	6	101.2487	13.40**
4	as	r(as)	86.508	12	7.2090	0.95
5	r(as)		317.333	42	7.5556	

Table 5.3 Analysis of Variance for Act-out Task 1

	SOURCE	ERROR TERM	SUM OF SQUARES	D.F.	MEAN SQUARE	F
1	MEAN	r(as)	21533.36	1	21533.3571	4019.56
2	ages	r(as)	340.43	2	170.2143	31.77**
3	sentence	r(as)	1895.14	6	315.8571	58.96**
4	as	r(as)	135.57	12	11.2976	2.11
5	r(as)		112.50	21	5.3571	

Table 5.4 Analysis of Variance for Act-out Task 2

	SOURCE	ERROR TERM	SUM OF SQUARES	D.F.	MEAN SQUARE	F
1	MEAN	r(as)	13072.111	1	13072.1111	1518.05
2	ages	r(as)	732.389	2	366.1944	42.53**
3	sentence	r(as)	1316.556	5	263.3111	30.58**
4	as	r(as)	41.944	10	4.1944	0.49
5	r(as)		155.000	18	8.6111	

was significant ($p < 0.01$), but there was no interaction of age and sentence type.

The Newman-Keuls test (cf. Winer 1971) was employed for the purpose of testing the difference of cell means for each significant effect. The results of the tests are described below.

5.2.1.1 Story task 1

The results of the Newman-Keuls test are given in Table 5.5. Performance increased with age. A significant difference was found between 5-year olds and the two other age groups of 3- and 4-year-olds.

The results of the Newman-Keuls test indicate that performance on V-ta toki was significantly different from -nagara, V-te, sorekara, ato and mae (Table 5.6). Figure 5.1 demonstrates that V-ta toki was noticeably lower than the other sentence types, which, in turn, were not significantly different from each other.

In story tasks 1 and 2, the stimulus sentences were questions: e.g. "Kono ko wa gohan o tabeta ato, nani o simasuka" 'What does this child do after he has a meal?' Most of the responses were given in the form of a simple sentence which comprised the event in the main clause of the question sentence: "Ha o migakuno" 'He/she brushes his/her teeth.'

5.2.1.2 Story task 2

The results of the Newman-Keuls test found in Table 5.7 again show that performance increased with age. Each age group differed significantly from the other two.

As shown in Figure 5.2, performance on V-ru toki was considerably lower than the others. The results of the Newman-Keuls test in

Figure 5.1 Sentence Type (Story Task 1)

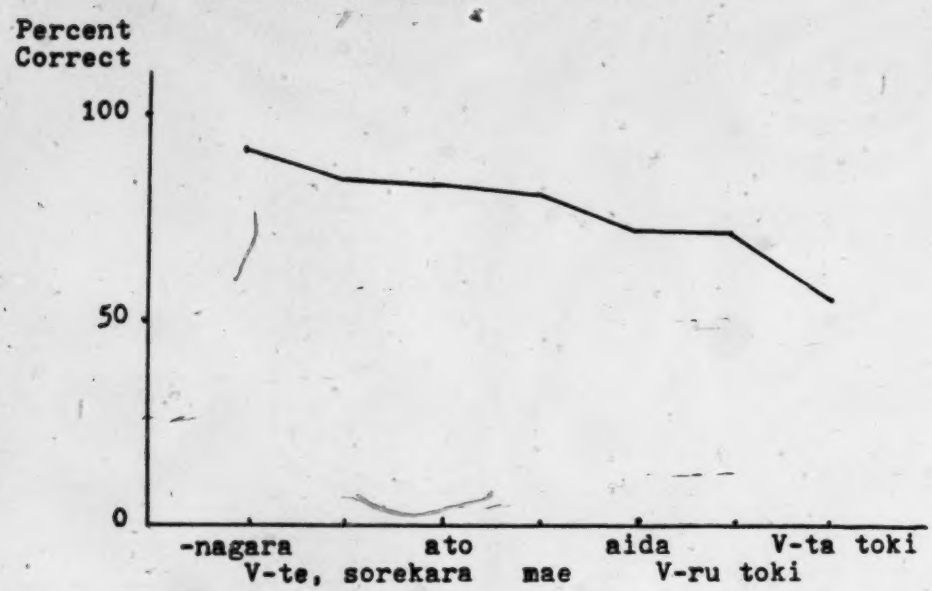


Figure 5.2 Sentence Type (Story Task 2)

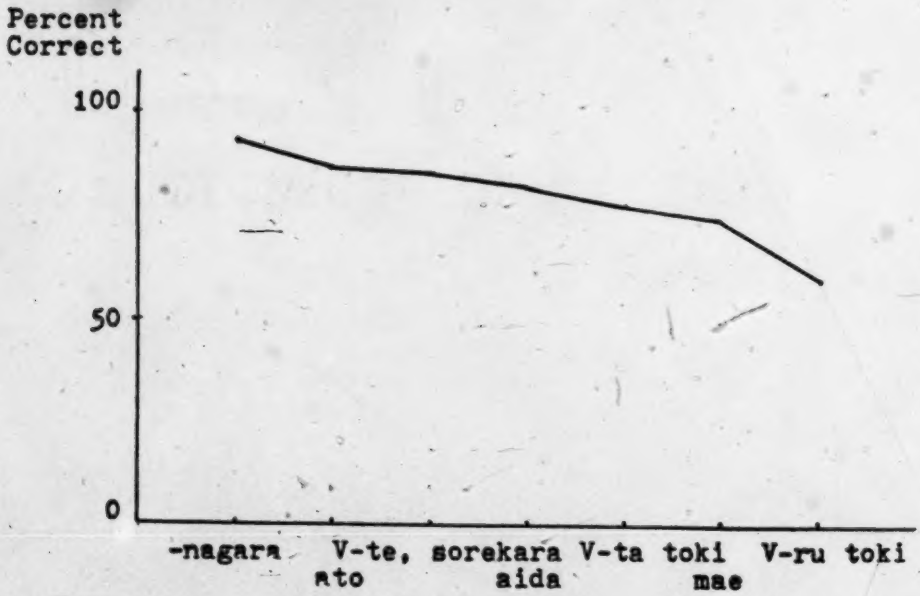


Table 5.5 Newman-Keuls Comparisons of Means (Q Values) for Age (Story Task 1)

	3	4	5
3	-	3.506	7.38**
4		-	3.87**
5			-

Table 5.6 Newman-Keuls Comparisons of Means (Q Values) for Sentence Type (Story Task 1)

	V-ta toki	aida V-ru toki	mae	ato	V-te, sorekara	-nagara
V-ta toki	-	2.96	4.53**	4.91**	5.16**	6.29**
V-ru toki aida		-	1.58	1.95	2.20	3.34
mae			-	0.37	0.63	1.76
ato				-	0.25	1.39
V-te, sorekara					-	1.13
-nagara						-

Table 5.7 Newman-Keuls Comparisons of Means (Q Values) for Age (Story Task 2)

	3	4	5
3	-	8.08**	13.48**
4		-	5.4 **
5			-

Table 5.8 indicate that V-ru toki was significantly different from other sentence types. Of the seven types -nagara was easiest: the rest of the five sentences did not significantly differ.

5.2.1.3 Act-out task 1

Table 5.9 represents the results of the Newman-Keuls test for age. Although performance increased with age, the performance of 5-year-olds only obtained a significant difference from the other two age groups.

As can be seen from Figure 5.3, performance on V-ru toki and mae were significantly lower than the other sentence types. The results of the Newman-Keuls test demonstrates that these two were significantly harder to process than the others in this act-out task (Table 5.10). Poor performance of V-ru toki was expected, as stated in Hypothesis 2. The results for mae, however, were not predicted. Most of the errors on mae sentences were those in which children did not act out the event in the embedded clause (81.5% of all the errors). Interestingly, the same type of errors was also observed on V-ru toki sentences, though to a lesser degree (65.2% of all the errors). An analysis of the error patterns on these sentences as well as other sentence types will follow in the Discussion section.

In the story tasks, stimulus sentences of V-ru and V-ta sentences were constructed such that the clausal order of V-ta toki sentences corresponded to the event order, whereas that of V-ru toki sentences was in a reversed order of events. In act-out tasks, on the other hand, both V-ru and V-ta toki sentences could be processed in two ways: the first is that explained above, while the second is a

Figure 5.3 Sentence Type (Act-out Task 1)

Table 5.8 Newman-Keuls Comparisons of Means (Q Values) for Sentence Type (Story Task 2)

	V-ru toki	mae	V-ta toki	aida	V-te, sorekara	ato	-nagara
V-ru toki	-	4.86**	6.31**	7.52**	8.73**	8.97**	11.41**
mae		-	1.45	2.66	3.88	4.12	6.55**
V-ta toki			-	1.21	2.42	2.66	5.10**
aida				-	1.21	1.45	3.89
V-te, sorekara					-	0.24	2.67
ato						-	2.43
-nagara							-

Table 5.9 Newman-Keuls Comparisons of Means (Q Values) for Age (Act-out Task 1)

	3	4	5
3	-	3.23	10.98**
4		-	7.74**
5			-

Table 5.10 Newman-Keuls Comparisons of Means (Q Values) for Sentence Type (Act-out Task 1)

	mae	V-ru toki	V-ta toki	aida	-nagara	ato	V-te, sorekara
mae	-	1.23	11.64**	11.80**	16.40**	17.28**	19.22**
V-ru toki		-	10.41**	10.58**	15.17**	16.15**	17.99**
V-ta toki			-	0.17	4.76**	5.64**	7.58**
aida				-	4.59**	5.47**	7.41**
-nagara					-	0.88	2.81
ato						-	1.94
V-te, sorekara							-

simultaneous processing of the events in both main and embedded clauses. Thus, either way of acting out these sentences by children was coded as correct.

5.2.1.4 Act-out task 2

Performance increased with age. A marked, significant difference was obtained at the age of five (Table 5.11). The children generally found this task to be difficult (Figure 5.4). One thing to be noted is that while the performances of 5-year-olds did not change very much across the four tasks, those of younger children did. The figure shows that the performances of 3- and 4-year-olds were not consistent yet and were task dependent.

Both Figure 5.5 and the results of the Newman-Keuls test in Table 5.12 demonstrate a clear separation of the sentence types into two groups. The better group consisted of the sentence types which could be acted out in accordance with an order-of-mention strategy: V-te, sorekara, ato and V-ta toki. In these sentences the event in the first clause is acted out first, followed by an act-out of the event in the second clause. In contrast, the sentences in the other group could not be processed in such an order: processing of the second clause first for mae and V-ru toki, and a simultaneous processing of both clauses for aida. The results of act-out task 2, consequently, seem to present a classical example of children's response patterns in an act-out task that as a task becomes complicated, children tend to resort to an order-of-mention strategy by which they can process experimental sentences mechanically.

Table 5.11 Newman-Keuls Comparisons of Means (Q Values) for Age (Act-out Task 2)

	3	4	5
3	-	3.73	12.69**
4		-	8.96**
5			-

Table 5.12 Newman-Keuls Comparisons of Means (Q Values) for Sentence Type (Act-out Task 2)

	V-ru toki	aida	mae	V-ta toki	ato	V-te, sorekara
V-ru toki	-	0.83	1.94	9.74**	10.58**	12.25**
aida		-	1.11	8.90**	9.74**	11.41**
mae			-	7.80**	8.63**	10.30**
V-ta toki				-	0.83	2.50
ato					-	1.67
V-te, sorekara						-

Figure 5.4 Children's Performances on the Tasks

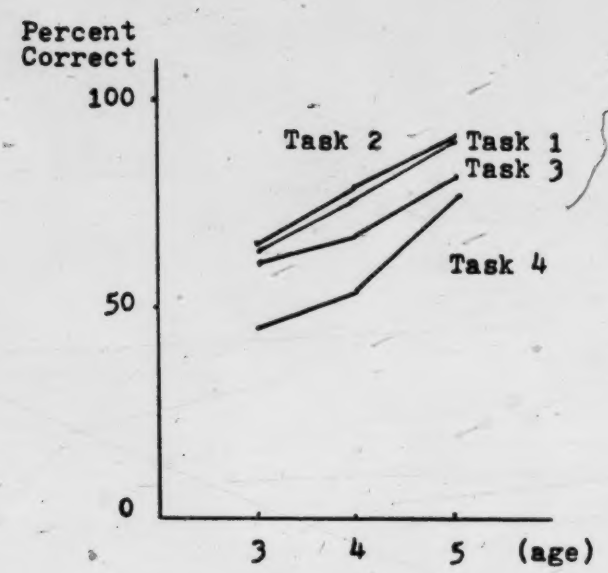
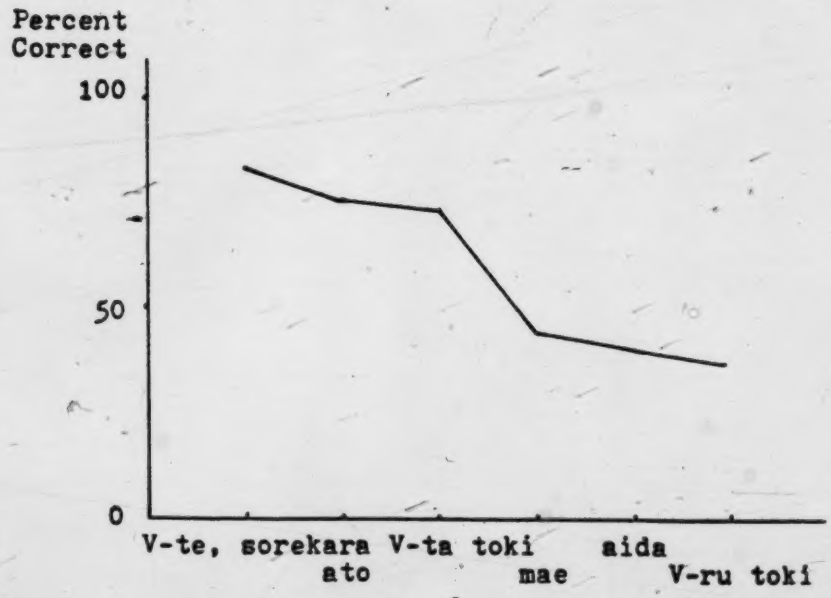


Figure 5.5 Sentence Type (Act-out Task 2)



5.2.1.5 Relative clauses

This task was conducted to see whether the children may use V-ru/ta forms as a cue on processing sentences. A three-way analysis of variance was conducted to invesigate the effects of age, tense and lexical type. The results of the ANOVA indicate that each main effect was significant: age ($p < 0.01$), tense ($p < 0.01$) and lexical type ($p < 0.01$). An interaction of tense and lexical type was also found to be significant ($p < 0.01$, Table 5.13).

The results of the Newman-Keuls test in Table 5.14 indicate the performances of 5-year-olds were significantly different from the other two age groups.

Figure 5.6 demonstrates the higher performance on the V-ta forms. All the V-ta forms were significantly better than their counterparts of the V-ru forms. The children have not learned yet that the V-ru form expresses an imminent action in the stimulus sentences used in the experiment. The only exception was the V-ru form of kau 'buy' which was significantly different from other V-ru forms (Table 5.15). The discussion of this and other responses will follow in the Discussion section.

5.2.2 Experiments II and III: The data of grade 5 and 6 children and adults

5.2.2.1 Act-out task 2 and relative clauses

Group scores of act-out task 2 were obtained from grade 5 and 6 children. A two-way analysis of variance was performed to investigate the effects of age and sentence type. The results of the ANOVA are shown in Table 5.16. Each main effect was significant: age ($p < 0.05$)

Table 5.13 Analysis of Variance for the Relative Clause Task

	SOURCE	ERROR TERM	SUM OF SQUARES	D.F.	MEAN SQUARE	F
1	MEAN	atl	14.912469	1	14.9124688	2448.00
2	ages	atl	0.069906	2	0.0349528	5.74*
3	tense	atl	3.940225	1	3.9402252	646.82**
4	lexical	atl	0.189114	5	0.0378228	6.21**
5	at	atl	0.021050	2	0.0105250	1.73
6	al	atl	0.051661	10	0.0051661	0.85
7	tl	atl	0.397358	5	0.0794717	13.05**
8	atl		0.060917	10	0.0060917	

Table 5.14 Newman-Keuls Comparisons of Means (Q Values) for Age (The Relative Clause Task)

	3	4	5
3	-	1.38	4.67*
4		-	3.28*
5			-

Table 5.16 Analysis of Variance for Act-out Task 2

	SOURCE	ERROR TERM	SUM OF SQUARES	D.F.	MEAN SQUARE	F
1	MEAN	r(as)	2185.04167	1	2185.041667	52441.00
2	ages	r(as)	0.37500	1	0.375000	9.00*
3	sentence	r(as)	11.20833	5	2.241667	53.80**
4	as	r(as)	1.87500	5	0.375000	9.00**
5	r(as)		0.50000	12	0.041667	

Table 5.15 Newman-Keuls Comparisons of Means (Q Values) for Tense by Lexical Type

	tobikoeru	hairu	noboru	suberu	noru	kau	katta	notta	tobikoeta subetta	nobotta haitta
tobikoeru (jump over)	-	0.37	1.04	3.56	3.84	11.56**	16.44**	18.22**	18.29**	18.67**
hairu (jump over)		-	0.67	3.1**						
hairu (go into)		-	0.67	3.18	3.47	11.18**	16.07**	17.84**	17.91**	18.29**
noboru (climb up)			-	2.51	2.8	10.51**	15.40**	17.18**	17.24**	17.62**
suberu (slide down)				-	0.28	8.00**	12.89**	14.67**	14.73**	15.11**
noru (ride)					-	7.71**	12.6 **	14.38**	14.44**	14.82**
kau (buy)						-	4.89**	6.67**	6.73**	7.11**
katta (bought)							-	1.78	1.84	2.22
notta (rode)								-	0.07	0.44
tobikoeta (jumped over) subetta (slid down)									-	0.38
nobotta (climbed up) haitta (went into)										-

(Tense/aspect is encoded in V-ru/-ta forms)

Figure 5.6 Lexical Type (The Relative Clause Task)

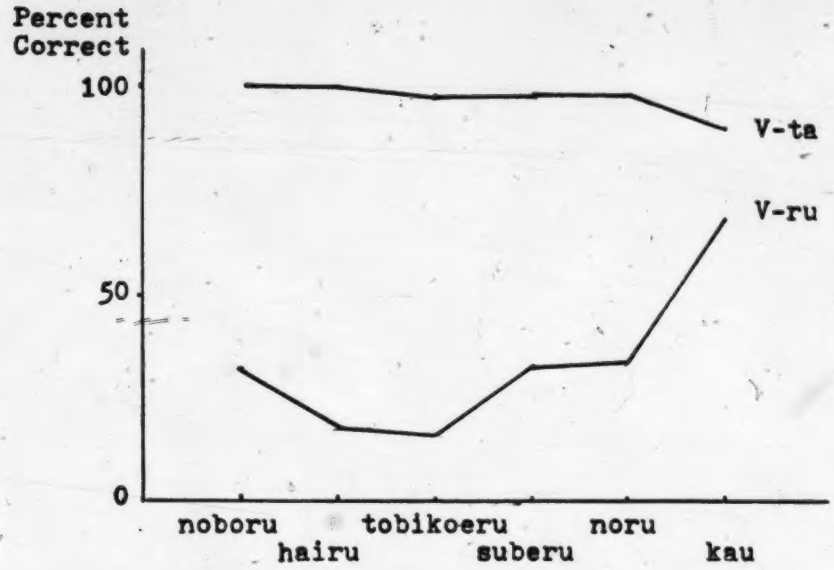
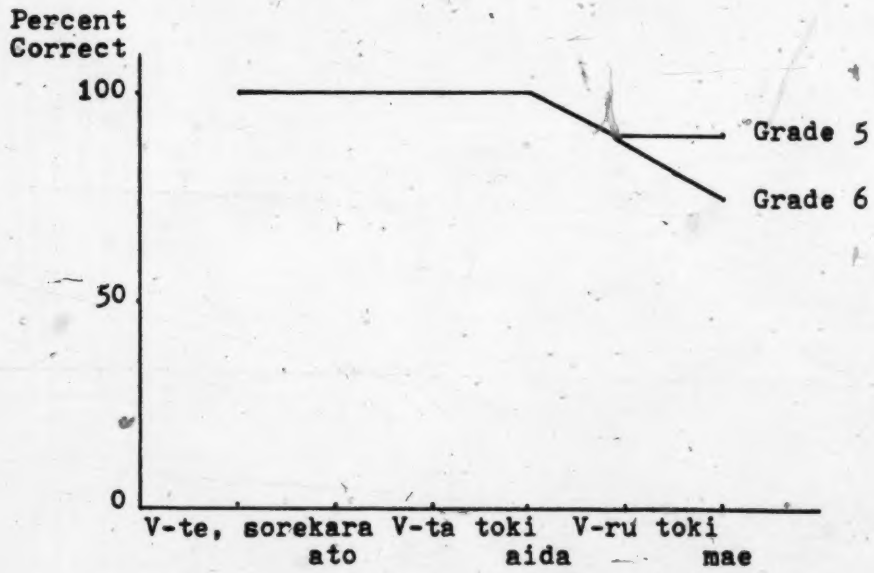


Figure 5.7 Sentence Type (Act-out Task 2)



and sentence type ($p < 0.01$). There was also a significant interaction of age and sentence type.

The results of the Newman-Keuls test (Table 5.17) present a similar pattern observed in the children's results: while grade 5 and 6 children obtained perfect scores in the V-te, sorekara, ato, aida, and V-ta toki sentences, their performances on the V-ru toki and mae sentences lagged behind. (Figure 5.7). These differences were significant. The poor performances of grade 5 children on mae were apparently caused by a sampling imbalance since each group consisted of only ten subjects. With the exception of one response, all the errors on mae ni and V-ru toki were the same kind of errors as those made by the 3- to 5-year-old children: the event in the embedded clause was not acted out. Such results demonstrate that even grade 6 children have not attained a full competence in processing these temporal clauses. (For reference, adults all acted out the events in both clauses.)

5.2.2.2 Duration

A three-way analysis of variance was performed on the duration scores of V-ta and V-te ita sentences obtained from the three age groups: grade 5 and 6 children and adults.[1] The ANOVA in Table 5.18 demonstrates that a main effect of duration and lexical type was significant ($p < 0.01$). In addition, there was a significant interaction of age and duration ($p < 0.01$).

Table 5.19 shows that the verb tobikoeru 'jump over' was clearly different from other verbs in the number of times acted. There was no other significant difference. When acting out the sentence "Otoko

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[1]As reported earlier in 4.2.2.1 the children could not distinguish V-te ita sentences from V-ta sentences in the pilot study which tested for sensitivity to the difference of duration expressed by the progressive and the past simple sentences in the verb duration task. As a result, this task was employed only for the subjects at these age levels.

Table 5.17 Newman-Keuls Comparisons of Means (Q Values) for Age by Sentence Type

	mae (G6)	V-ru toki (G5) (G6) mae (G5)	Others
mae (G6)	-	10.40**	17.33**
mae (G5) V-ru toki (G5) (G6)		-	6.93**
Others			-

Table 5.18 Analysis of Variance for the Duration Task

	SOURCE	ERROR TERM	SUM OF SQUARES	D.F.	MEAN SQUARE	F
1	MEAN	adl	17013.38	1	17013.375	
2	ages	adl	193.75	2	96.875	3.52
3	duration	adl	1395.38	1	1395.375	50.77**
4	lexical	adl	1930.46	3	643.486	23.41**
5	ad	adl	666.75	2	333.375	12.18**
6	al	adl	183.92	6	30.653	1.12
7	dl	adl	324.46	3	108.153	3.93
8	adl		164.92	6	27.486	

Table 5.19 Newman-Keuls Comparisons of Means (Q Values) for Lexical Type

	tobikoeru	nameru	naderu	tataku
tobikoeru (jump over)	-	7.55**	9.73**	10.67**
nameru (lick)		-	2.18	3.12
naderu (stroke)			-	0.93
tataku (hit)				-

no ko ga inu o tobikoete ita" 'The boy was jumping over the dog,' the children let a boy doll jump over the dog just once. Such an action resulted in no difference from the same sentence including tobikoeta 'jumped' instead. The adults averaged two times of jumping actions on tobikoete ita sentences.

Table 5.20 demonstrates that at neither grade 5 nor 6 age level was there a significant difference between the number of times V-ta sentences were acted out and the number of times V-te ita sentences were acted out. Figure 5.8 presents the difference between these two forms at each age level. A significant difference was obtained only at the adult level. The acquisition of duration by Japanese children is extremely late, judging from English data reported in Feagans (1980). Consequently, in contrast to the adults, there was no difference found in the performances of those children between aida sentences which had V-ta and those which had V-te ita in the main clause, respectively.

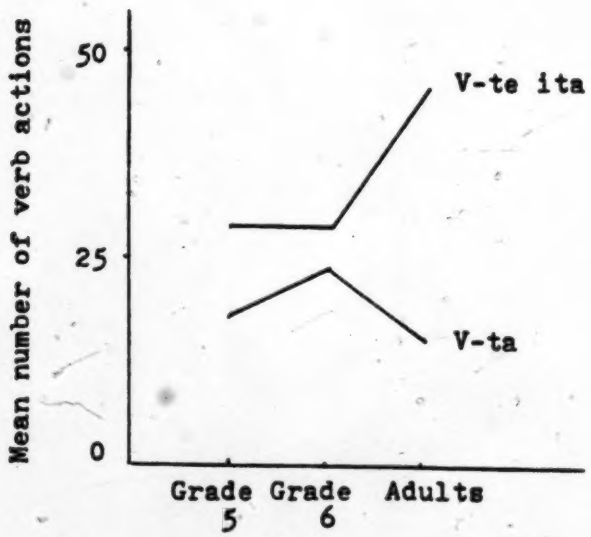
In summary, the main findings of the four main tasks are that performance increases with age and ease of processing of sentence types is task-dependent. In both story tasks, -nagara sentences were found easiest. There were no performance differences on other sentence types, except V-ta toki in story task 1 and V-ru toki in story task 2.

In the act-out tasks, on the other hand, the sentence types which could be acted out in accordance with an order-of-mention strategy were easier than those which could not be acted out in accordance with the strategy. The tendency was even more clearly shown in act-out task 2, the more complicated one of the pair. The former included the sentences of V-te, sorekara, ato and V-ta toki and the

Table 5.20 Neyman-Keuls Comparisons of Means (Q Values) for Age by Duration

	V-ta (adults)	V-ta (G5)	V-ta (G6)	V-te ita (G6)	V-te ita (G5)	V-te ita (adults)
V-ta (adults)	-	0.95	3.05	4.96	5.15	11.35**
V-ta (G5)		-	2.10	4.01	4.20	10.40**
V-ta (G6)			-	1.91	2.10	8.30**
V-te ita (G6)				-	0.19	6.39**
V-te ita (G5)					-	6.20**
V-te ita (adults)						-

Figure 5.8 Duration Scores by Age Group



latter those of aida, mae and V-ru toki. Most of the errors on mae and V-ru toki sentences were those in which children acted out the event in the main clause only.

A consistent age effect was also observed in the relative clause task. In this task, all the V-ta forms were found to be far easier than the V-ru forms. Among the V-ru forms, the verb kau 'buy' was singled out to be processed better.

Grade 5 and 6 children and adults participated in act-out task 2, the most difficult one of the four main tasks. The results obtained from the data of grade 5 and 6 children demonstrated that even those older children made the same type of mistakes on mae and V-ru toki as the younger children; i.e., they acted out the event in the main clause only. The adults all acted out the events in both clauses.

Finally, the duration scores obtained from grade 5 and 6 children and adults indicated that even grade 5 and 6 children did not see the difference between V-ta and V-te ita sentences of momentary verbs. Accordingly, in contrast to the adults, there was no difference found in the performances of those children between aida sentences which had V-ta and those which had V-te ita in the main clause, respectively.

5.3 Analysis of Responses and Evaluation of the Hypotheses

In this section responses to stimulus sentences will be analyzed and each of the three hypotheses will be evaluated in turn. First, Hypothesis 1 is stated again as follows:

> Hypothesis 1: The developmental order of temporal connectives is isomorphic with that of the development/emergence of temporal notions.

Hypothesis 1 was formulated to test whether the developmental sequence of temporal connectives in the present study can be predicted by the developmental order of the corresponding notions. The predicted order of Japanese connectives based on conceptual notions is in the order sequence V-te, sorekara 'and then' > simultaneity toki 'when' and -nagara/aida 'while' > mae/ato 'before/after.' The order was evaluated in light of the experimental results.

The present study adopted two kinds of comprehension tasks: a story comprehension and an act-out task. Each task had two sub-tasks. The results obtained in these tasks were different across tasks in terms of percent correct and response patterns (cf. Figure 5.4 and Table 5.21). The act-out tasks were more difficult than story tasks. For instance, two 3-year-olds who completed the story tasks could not perform the act-outs. Act-out task 2 was the most difficult. The results of the ANOVA show that there is no significant difference between the two story tasks (Table 5.21) but a significant difference between the two act-outs ($p < 0.01$) (Table 5.22). There was a significant interaction of task and sentence type in both comparisons ($p < 0.01$).

Table 5.21

Analysis of Variance for Story Tasks 1 and 2

	SOURCE	ERROR TERM	SUM OF SQUARES	D.F.	MEAN SQUARE	F
1	MEAN	r(tas)	78101.3413	1	78101.3413	4389.28
2	tasks	r(tas)	27.6270	1	27.6270	1.55
3	ages	r(tas)	1452.4921	2	726.2460	40.81**
4	sentence	r(tas)	985.3810	6	164.2302	9.23**
5	ta	r(tas)	8.3016	2	4.1508	0.23
6	ts	r(tas)	342.6508	6	57.1085	3.21**
7	as	r(tas)	139.6190	12	11.6349	0.65
8	tas	r(tas)	48.9206	12	4.0767	0.23
9	r(tas)		1494.6667	84	17.7937	

Table 5.22

Analysis of Variance for Act-out Tasks 1 and 2

	SOURCE	ERROR TERM	SUM OF SQUARES	D.F.	MEAN SQUARE	F
1	MEAN	r(tas)	30053.347	1	30053.3472	4201.63
2	tasks	r(tas)	136.125	1	136.1250	19.03**
3	ages	r(tas)	1005.778	2	502.8889	70.31**
4	sentence	r(tas)	2746.236	5	549.2472	76.79**
5	ta	r(tas)	44.333	2	22.1667	3.10
6	ts	r(tas)	288.792	5	57.7583	8.07**
7	as	r(tas)	104.889	10	10.4889	1.47
8	tas	r(tas)	54.000	10	5.4000	0.75
9	r(tas)		257.500	36	7.1528	

The response patterns of the act-outs were also different from those of the story tasks. In act-out tasks the percent correct of sentences in which the order of events corresponded to the order of occurrences was higher than those in which the event order did not match the order of occurrences. The tendency was more strongly reflected in the hardest task (act-out 2), as pointed out in the previous section. Due to the differential results, the results of the story tasks and act-out tasks will be discussed separately.

In both story tasks, the sentence types were found to be significantly different, but there was no interaction of age and sentence types. As can be seen in Table 5.23, performances of the 4-year-olds are already high with the exception of V-ta toki in story task 1, which might have been caused to some degree by particular stimulus pictures shown, and V-ru toki in story task 2.[2] Hence it can be concluded

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[2]For example, correct responses of the V-ta toki were few for the picture showing a child's leaving home for kindergarten. For that picture, it was easier to elicit an answer to the question "What does this boy say when he goes to school?"

that these temporal connectives are almost mastered by the end of the fifth year. Therefore, the performance of the youngest group will be examined in order to grasp the developmental differences of these temporal connectives. The results in the story tasks generally corroborate the findings described in Takahashi (1975), but not those in Suzuki (1972). According to Suzuki, performance on mae sentences was not perfect even at the age of 6;9. In the present experiment the children performed close to perfect at the age of 5;9. The difference can be attributed to different types of tasks, which will be discussed later.

What is different from Takahashi (1975), however, is the performances of the 3-year-olds. Taskahashi could not find a single instance of mae/ato and aida sentences in the production data of 3-year-old children. Yet, the results in the present experiments have shown that the children can understand these sentence types in more than half of the cases (Table 5.23). This may be a good example of comprehension preceding production in child language learning.

Among the seven connectives, performance on -nagara sentences was particularly good for the 3-year-olds, followed by V-te, sorekara and ato in both tasks. This rather poor showing for the V-te, sorekara was not expected. The results did not support Hypothesis 1 which predicts the precedence of V-te, sorekara over -nagara. Okubo (1973) pointed out that the V-te, sorekara did not appear very often in her production data of 3-year-olds. V-te, sorekara, the Japanese equivalent of and then, may not actually be equivalent in its function to express temporal sequence of sentences. Japanese children are

Table 5.23

Percentage of Correct Responses for Each Temporal Term in Each Task by Age

	Story Task 1			Story Task 2		
Age	3;10	4;9	5;9	3;10	4;9	5;9
nagara	82.3	88.5	99.0 (%)	84.4	93.8	99.0 (%)
V-te, sorekara	67.7	85.4	97.9	67.7	88.5	97.9
ato	65.6	83.8	97.9	66.7	91.7	97.9
mae	63.5	78.1	99.0	58.3	69.8	92.7
aida	52.1	72.9	89.6	68.8	86.5	88.5
V-ru toki	60.4	72.9	81.3	47.9	57.3	74.0
V-ta toki	51.0	50.0	64.6	66.7	79.2	87.5

	Act-out Task 1			Act-out Task 2		
age	3;10	4;9	5;9	3;10	4;9	5;9
nagara	75.0	90.6	93.8 (%)	---	---	--- (%)
V-te, sorekara	95.3	90.6	98.4	70.3	81.3	98.4
ato	81.3	85.9	100.0	62.5	73.4	95.3
mae	26.6	29.7	57.8	35.9	35.9	62.5
aida	59.4	73.4	85.9	20.3	34.4	67.2
V-ru toki	40.6	34.4	50.0	25.0	31.3	56.3
V-ta toki	53.1	70.3	93.8	56.3	73.4	92.2

well-known for their overuse of the V-te form to connect sentences (cf. Okubo, 1973). The V-te form then may initially be quite sufficient for connecting sentences sequentially. In fact, the V-te form is used quite often to connect sequential actions in T's language data recorded on his third birthday.

Another explanation for the poor performance on V-te, sorekara may be its other competing functions in child language. Okubo (1973) mentioned that the children's main use of sorekara, among other possible uses, was to conjoin words. An example of its use can be seen in sentence (15) which was uttered by a 5-year-old boy (p. 231).

(15) Kiku no hana toka sorekara nee bara no hana toka sooiu
mum of flower like and say rose like that

hana tunda no.
picked

I picked such flowers as mums and roses.

It is often noted in child language learning that for forms which have already been used to express a particular function a different function for those same forms does not develop readily (Prideaux, 1979; Slobin, 1973). This developmental principle of grammatical uniqueness might explain the poor performance on V-te, sorekara, since sorekara is used for second different function, namely of conjoining words in the sense of and.

In contrast, -nagara which is attached to the V-stem expresses only simultaneous actions at the initial stage, although Takahashi (1975) divided the children's use of -nagara into two groups: (1) simultaneous actions, as in "Sore mi-nagara ohirune siteta no" 'I was taking a nap while looking at it,' and (2) the adverbial use of -nagara clause which modifies the simultaneously occurring action in the main clause, as in "usagi ga ne pyon pyon hane-nagara nigeta no"

'The rabbit ran away hopping'. There will be further discussion of this form later.

Performance on ato came a close third to that of V-te, sorekara. Performance on mae was good in story task 1, but not so good in task 2. Good results of ato may suggest the function of a local cue at work. Performance on the rest of the sentence types was not clear enough to suggest any developmental order among them. In other words, all those connectives may have been learned approximately to the same degree, and the best results of the connectives might be brought out when the optimum stimulus is provided for them.

In the results of the act-out tasks, there were two main findings: (1) performance on the sentences of which the event order described corresponds to the order of occurrence of events was significantly better than performance on those in which the order of events described does not correspond to the order of occurrence of events, and (2) performance on mae and V-ru toki was extremely poor. There was no interaction of age and sentence types. When mae and V-ru toki were excluded, the performance of 4-year-olds was again fairly good, indicating the acquisition of the rest of the connectives by the end of the fifth year. In what follows, the main findings are discussed.

As in most of the act-out tasks, performance on the sentences where the order of mention of events mirrored the order of occurrence of events was good. In fact, the performances of the 3-year-olds on V-te, sorekara turned out to be much higher than for those on -nagara sentences in act-out task 1. This was also the case with regards to performance on ato sentences. Consequently, the data were inspected to see whether children consistently adopted the order-of-mention strategy. Such biased responses were not found in act-out task 1, whereas

in task 2 there were two 4-year-olds and four 3-year-olds who adopted that strategy for all sentence types. This response tendency inflated the percent correct for V-te, sorekara, ato and V-ta toki by 12.5%, 12.5% and 6.3%, respectively. The biased response tendency, however, did not account for the good performance of the 3-year-olds on V-te, sorekara in act-out 1.

Another main outcome which was not expected was a peculiar response pattern for mae; the majority of children acted out the action in the main clause only. Some children, however, did not simply neglect to act out the action in the embedded clause. They moved the toy to the onset position of the action expressed in the embedded clause, and stopped there to produce the effect that the V-ru form in mae clause expressed an impending action rather than an action which was incomplete at the time of occurrence of the action expressed in the main clause. For example, in sentence (16) the child first clapped the hands of a rabbit and then moved the rabbit in front of the ball.

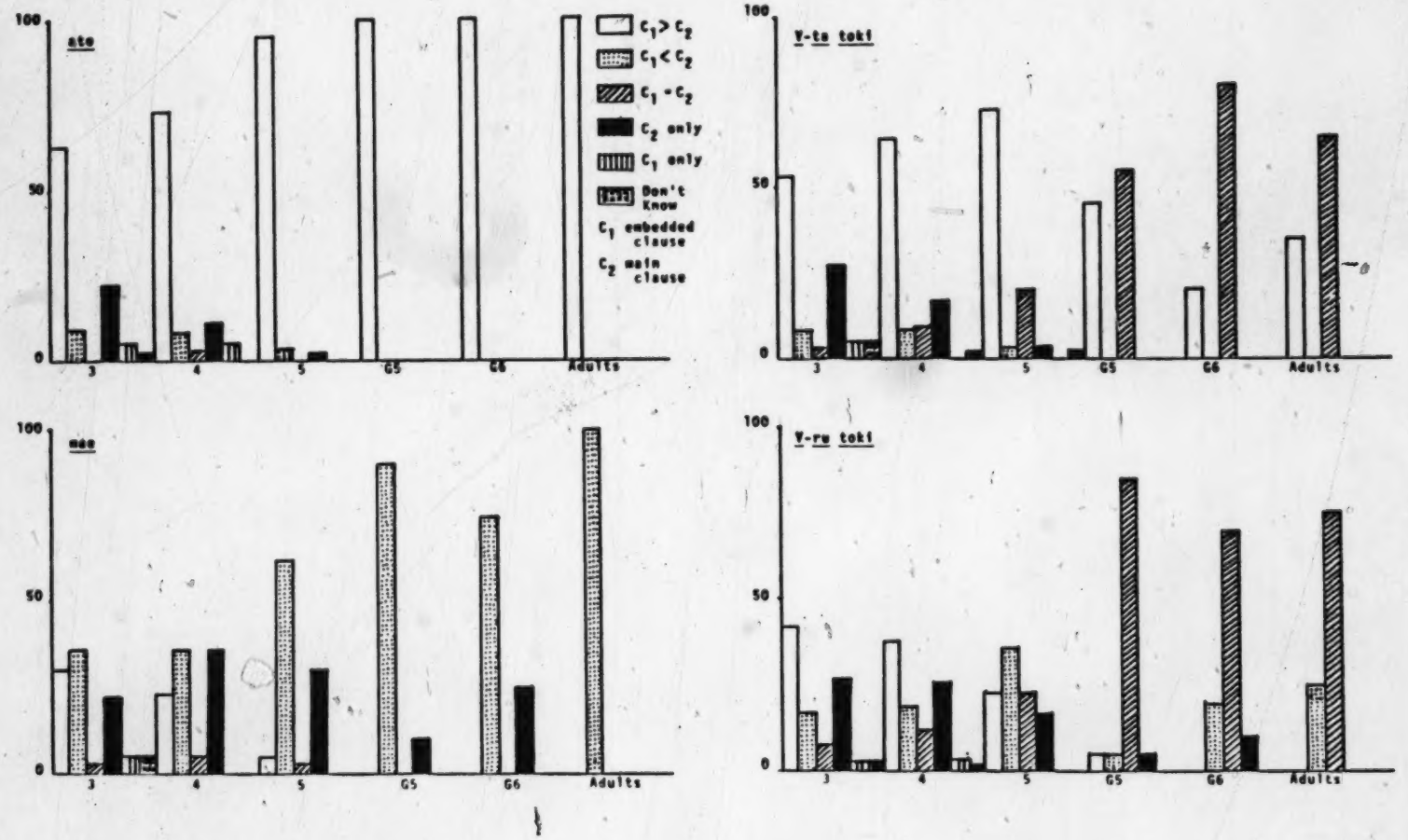
(16) Usagi ga booru o keru mae ni, te o tataita.
rabbit ball kick before hands clapped

Before the rabbit kicked the ball, he clapped his hands.

This response tendency persists through to the age of 11 and 12, as it constituted 10% of grade 5 and 25% of grade 6 children's total responses in act-out task 2 (see Figure 5.9). A similar tendency was also observed with responses concerning V-ru toki sentences, though to a lesser degree. This tendency leads one to speculate that the children may be using the V-ru form as a local cue, though not properly, and, accordingly, process mae and V-ru toki sentences incorrectly.

Finally, performance on aida sentences was generally lower than that of ato sentences but higher than that of mae sentences in story

Figure 5.9 Distribution of Responses to Ato, Mae, V-ta toki and V-ru toki Sentences for Act-out Task 2



task 1 and act-out task 1. In contrast to -nagara, the connective aida develops late even though both express the same temporal notion of simultaneity. The slow development of aida also suggests that factors other than the semantic notion may help to determine the time of the acquisition of the word.

In summary, Hypothesis 1 is not supported by the results of the present experiments. It is speculated that factors other than conceptual notions may be in effect for the acquisition of temporal connectives. This possibility will now be discussed.

Hypothesis 2: Local cues, the V-ru/ta forms in mae/ato 'before/after' clauses, facilitate the development of these sentences.

Hypothesis 2 predicts the developmental precedence of temporal connectives mae/ato 'before/after' to toki/aida' 'when/while.' The hypothesis is formulated to test the role of local cues in the acquisition of Japanese temporal connectives. Local cues exist in the simultaneous clauses of toki and aida, but they are predicted not to function as effectively as processing cues in these sentences as in mae/ato sentences. It was previously observed that the V-ta form signifies the completive aspect, and the V-ru forms, the incompletive aspect. Since the event in the mae clause always follows that in the main clause, the verb phrases in the embedded clause of mae should be in the V-ru form regardless of the tense of the main clause. The verbs in the ato clauses, on the other hand, should be in the V-ta form, since the event in these clauses occurs prior to that in the main clause. In other words, verb forms which co-occur with mae/ato connectives are always in the same (and regular) forms. In contrast, a unique co-occurrence of verb forms and connectives does not occur in toki and aida clauses. Since the child is known to acquire regular forms first (Slobin, 1973),

mae/ato are predicted to develop earlier than toki/aida sentences. Hypothesis 2 therefore is formulated to predict the earlier development of mae/ato over toki/aida sentences.

As previously observed, performance on ato sentences was highest among the four sentence types, followed by V-ta toki. With the exception of story task 1, performance on mae sentences was not as high as that on ato and V-ta toki sentences, and comprehension of V-ru toki was about the same as that for mae. Performance on aida sentences could be placed in the middle of these two pairs. Due to the poor performance on the mae sentence, Hypothesis 2 was not supported.

The results from the story tasks clearly showed that children understood mae sentences. The performances of the five-year-olds in particular seem to corroborate the hypothesis, demonstrating that mae sentences yield better results than those of toki and aida. The poor performance, accordingly, resulted from a peculiar response pattern in the act-out tasks; namely the children tended to act out the action in the main clause only. The fact that this pattern was also more likely to be obtained in the V-ru toki than the ato and V-ta toki sentences indicates that this response tendency does not represent a main clause strategy, but the children's use of the V-ru/-ta forms as a processing cue in acting out sentences, although it is used incorrectly (see Table 5.24).

Table 5.24

Percentage of Performance of the Main Clause Only

	act-out 1	act-out 2
mae	51.6 (%)	29.3 (%)
V-ru toki	37.5	23.3
ato	7.3	11.7
V-ta toki	20.8	15.7

Decreasing errors of this type in act-out task 2 were attributed to increased numbers of other types of mistakes (especially of the order-of-mention strategy) in the more complicated task of the two act-outs. Figures 5.9 and 5.10 reveal that this response tendency peaked at the age of 4 in the mae and V-ru toki sentences. At the age of 5, the percentage correct score surpassed the error rate with a sudden growth of mae type of responses.

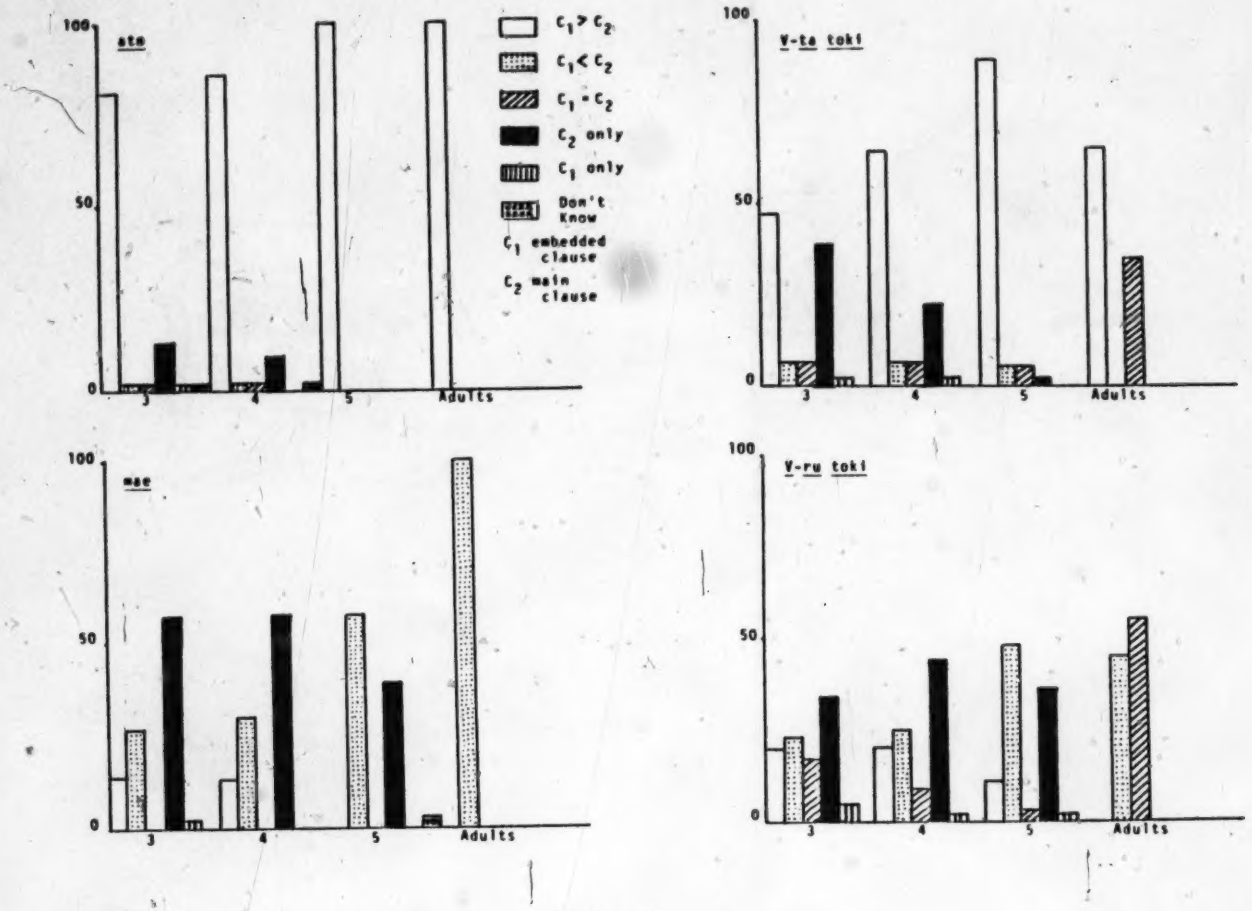
Slobin (1982) found the same response tendency for Turkish before clauses, as seen in the following quotations (p. 164):

> If Turkish children perform only one of the two actions called for in these sentences, they are twice as likely to make a single response in regard to the before sentences as the after sentences (35:17). They apparently interpret the negative particle in these sentences as meaning that one of the actions does not occur.

It is interesting to note that the same tendency is observed in Japanese mae sentences although they do not have a negative particle in the embedded clause.

In contrast to these two sentence types, performance on ato and V-ta toki sentences, which can be parsed by the order-of-mention strategy, was higher. The correct responses of these sentence types showed a steady increase over the age range studied.

Figure 5.10 Distribution of Responses to Ato, Mae, V-ta toki and V-ru toki Sentences for Act-out Task 1



As mentioned before, V-ta toki can be construed in another way, i.e., as simultaneous, as can V-ru toki. In fact, one adult consistently processed all the toki sentences as presenting simultaneous acts. The adult responses were shown for task 1 in Figure 5.10, together with those grade 5 and 6 children for task 2 in Figure 5.9.[3] A comparison between responses of small children and those of older children and adults showed that the responses of small children as simultaneous actions were few in number, although general response patterns were maintained in the children's responses. Such a low rate of simultaneous responses by children may be interpreted as a reliance on V-ru/-ta forms rather than on the connectives as a main sentence processing cue.

These results are comparable to the results reported by Harner (1976), who tested comprehension of before/after clauses in the task acted out by an experimenter. Harner prepared pairs of toys such as two boy dolls and two platforms. First, the experimenter moved one boy through the action, for example, she had the boy fall off a platform. Next, she moved another boy at the onset position of the action, and then said, "Now listen. Tell me which one I'm talking about" (p. 71). She made the statements such as "The boy before he falls/The boy after he falls." The results demonstrated that before was significantly better understood than after at each age level of 2 to 4. Harner interpreted the poor results of after as representing a difficulty due

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[3]With the exception of V-ta, toki in act-out 1, the percentage of simultaneous processing is higher than other types of responses of toki sentences in adult responses.

to the retrospective ordering, i.e., difficulty in referring to a representation of past actions or events. Harner also tested the same actions using the verb tense. The following statements were made: "The boy will fall/the boy has fallen." In this test, the future tense was significantly better understood at the age of 2 than the present perfect, but no such difference was found at the other age levels.[4] The results of the verb tense suggest that the poor performance reported for after may be due not so much to the retrospective ordering as to the use of the present tense in the after clause which referred to the action already completed. The children may have had trouble in interpreting the verb form in that context.

The assumption that the children may use V-ru/-ta forms as a cue on processing sentences was tested in the relative clause task which was designed after Harner (1976). As discussed in the previous chapter, stimulus sentence pairs such as sentence (17) were used. The sentence pair is similar to toki clause in its structure such that the head of the relative clause is the same for the pair. The temporal difference is only defined by the VP in the embedded clause.

(17) Hako o | tobikoeru / tobikoeta | ko wa dono ko desu ka.

box | will jump over / has jumped over | child which child is

Which child is the one who | will jump over / has jumped over | the box?

All V-ta forms were significantly better understood than their V-ru counterparts, as shown in Figure 5.6. The children have not yet

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[4]The present perfect is reported to develop late (Fletcher, 1980; Johnson, 1985).

learned that the V-ru form expresses an imminent action in the stimulus sentences used in the experiment. The only exception to this was the V-ru form of kau 'buy,' which was significantly different from the other V-ru forms.

The good performance on V-ta forms may have resulted from the way the experiment was conducted. In this task the children saw actions carried out by an experimenter, with the exception of the tasks involving the verb kau. In sentence (17) above, for example, the experimenter had a doll jump over the box, which referred to the clause "the boy who had jumped over the box." On the other hand, the doll standing beside an ice-cream man holding ice-cream represented "the boy who had bought the ice-cream," thus no transaction of the ice-cream occurred. The good performance on kau which did not involve an action gives the impression that the attention of the children might have been distracted by the action which had enforced the V-ta interpretation upon the ru form of other verbs. Such interpretation of the data, however, contradicts the results of the American children in Harner (1976) that the future tense form was better understood at the age of 2 than the present perfect form for a similar type of task.[5] Harner's findings demonstrate that the task itself does not necessarily bias small children toward adopting the responses which correspond to V-ta responses. Why, then, was the rate of V-ru responses so low in the relative clause task?

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[5]In Harner's experiments, a pair of simple sentences were used instead of relative clauses; the boy will fall/the boy has fallen. Thus, it could be argued that the relative clauses were harder than the simple sentences. However, the change of constructions does not seem to affect the performance of V-ru in particular.

An explanation for the difference from Harner's results may be sought in the semantic differences between the V-ru form and the English future tense. While auxiliary will + infinitive invariably denotes future, the V-ru does not. The latter actually parallels the English simple present in its use. In addition, the V-ru form refers to the definite as well as to the volitional future (Kunihiro, 1982), and also marks aspect in embedded clauses. The multi-functions of the V-ru form may make its acquisition harder for some functions, and the V-ru form in the relative clauses which expresses the imminent action above may be one of the more difficult of those functions. The comprehension of V-ru/-ta in simple sentences also needs to be tested to see whether children understand the use of V-ru in simple sentence constructions. In contrast to the V-ru form, V-ta expresses either the simple past or the completive aspect. Since its reference is less complex, V-ta is expected to be acquired earlier.[6] In fact, Rispoli (1982) reported an earlier emergence of V-ta in simple sentences in the language data of a one-year-old boy. The V-ta form appeared early and was used with three times as many verbs as the V-ru form by the child's second birthday.

The multi-functions of the V-ru form lead us to a speculation that the V-ru form was not salient enough to function as a local cue in the present relative clause task. Since the grade 5 and grade 6 children got perfect scores in this task, the acquisition of these

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[6]Ando (1982) suggests that the V-ta form is semantically marked, expressing the completive aspect, whereas the V-ru form is unmarked. The V-ru form is more complicated in its semantic description due to that fact.

constructions should have been completed at some time before the age of 11. In order to clarify the development of the V-ru form in the relative clause, it is important to conduct further research in tasks such as a picture task in which actions are not involved.

In fact, Harner (1981) in her English developmental study of tense and aspect, noted the tendency of the greater use of past-tense in goal-oriented situations like those adopted in the present study (also see Bloom, Sifter & Hafitz, 1980). Harner explains this tendency as reflecting the potential double function of coding completive aspect and past-tense.

It was suggested above that the children seemed to use V-ru/-ta as a cue in processing temporal cues. Although the children's performance on V-ru was not as good as that for V-ta, it was better than the performance on V-ru in the relative clauses. As the experimental tasks were different from each other, a comparison such as that made above may not be valid. According to Takahashi (1975), very few instances of relative clauses were found in the production data of 3- and 4-year-old children. In particular, not even a single case of aspectual use of V-ru/-ta in the relative clause was reported in those two age groups. The aspectual use of V-ru/-ta in toki clauses, however, already appeared in the production data of 3-year-olds. Therefore, its appearance is much earlier than that in the relative clause. Toki clauses may develop earlier than relative clauses since the former is semantically easier than the latter, simply giving time specification to the event or action stated in the main clause.

Among these four sentence types of mae/ato, toki, and aida, performance on ato sentences was best in all four tasks. In what follows, the ease of processing of ato sentences will be discussed, preceded by a brief examination of the input data.

Children's exposure to toki clauses appears to be very high. For example, we can consider the frequency of connectives used by a mother in recorded dialogues between her and her son, spread over twelve hours each on his second and third birthdays (KKK, 1981). The frequency of toki is much higher than that of other temporal connectives, as shown in Table 5.25.

Table 5.25

Numbers of Connectives

	The second birthday	The third birthday
toki	13	23
ato	1	1
mae	1	1
-nagara	1	10
aida	0	2

Furthermore, a typical Japanese textbook for first graders includes eight instances of toki in contrast to four -nagaras and no other connectives (Kokugo I, 1983). The production data also showed an earlier appearance of toki clauses over other temporal clauses, such as mae/ato and aida. Despite the plausibly high exposure to the toki clauses and its ostensibly proper use by children, comprehension of toki was not as good as that for ato.

The ato sentence seems to possess optimum attributes for it to be acquired by children, which other connectives lack. For example,

the ato sentence can be parsed by the order-of-mention strategy, which should be conceptually easy to understand. Secondly, ato is uniquely marked with its use in the temporal domain.[7] Furthermore, the only form which appears in the position preceding ato is V-ta. The uniqueness in semantic function and syntactic structure appears to be one of the key factors leading to the acquisition of Japanese temporal connectives. In the case of ato clauses, the unique marking of its use in the temporal domain and the unique co-occurrence of V-ta and the connective ato should be pointed out. In contrast, mae does not have the uniqueness of ato in its semantic function. Mae refers to the spatial as well as to the temporal domain just like its English counterpart, before.[8]

Previously, the developmental principle of grammatical uniqueness was argued to be useful for explaining the performance on V-te, sorekara. This principle also applies to the acquisition of English connectives reported in Bloom, Lahey, Hood, Lifter and Fiess (1980), as follows: (p. 255).

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[7]While the antonymn of mae in the temporal domain is ato, it is usiro in the spatial domain. Usiro is reported to appear a year later than ato (Okubo, 1968).

[8]On some occasions, the negative form of a verb occurs in the position preceding mae such as in sentence (a) (Kunihiro, 1981, p. 45; see also Matsunobe, 1964).

(a) Kurakunaranai mae ni kaerimashoo.
dark-become-not let's go home
Let's go home before it gets dark.

Imai (1981), however, notes that this expression is rarely heard nowadays except in the Okinawa Prefecture.

> The first connectives the children learned were non-homonymous (and, then, because). The homonymous connectives except for when (what, where, that and like), were learned in their non-connective contexts first. When, in contrast, was learned as a connective long before it was learned as a wh-question form (...). When homonymous forms were used as a connective, each was used with only one structure: when as a conjunction; what as a complementizer; and where as a relativizer.

Bloom et al. suggest a conceptual constraint on learning syntactically homonymous forms above.

The uniqueness in the semantic function operates in the same way as in grammatical uniqueness, but it is different from the latter in that semantic function is emphasized. This suggests that when learning temporal connectives, children first learn a term which is not semantically double-coded. Furthermore, the term which has been initially used to express a particular semantic function is not readily adapted to express a different function at a later stage.

A good example of uniqueness in semantic function and structure is also demonstrated in the differential performance of -nagara and aida. While both are simultaneous connectives, the performance of -nagara was best in story tasks 1 and 2. The suffix -nagara expresses the counter-to-expectation with stative verbs and punctual verbs. -Nagara first appeared as a simultaneous connective, and the use of the counter-to-expectation did not appear in children's production data at all (Takahashi, 1975). The -nagara construction is not syntactically complicated. Attached to the stem form of verbs, it expresses an action concurrent with the action expressed by the following verb. As such, -nagara actually forms an adverbial phrase, different from other connectives. Aida, on the other hand, does not have a uniqueness in semantic function and syntactic structures. Aida, just like mae, can also refer to the spatial domain, expressing "the space between." In

fact, it appears first as a word denoting this space (Okubo, 1968). In its structure not only the V-ru form but also the V-te iru form occurs with aida.

The most important factor which facilitates the acquisition of a temporal clause, however, is 'clear' and 'consistent' marking of its temporal relation to the event in the main clause, expressed by the verb form and a connective. Only if that is the case, aspect expressed by the verb form constitutes a local cue. The verb-ta form in the ato clause exactly applies to that case, by invariably expressing a prior event relation to that in the main clause. In contrast, the V-ru form in mae fails to function as a proper local cue since it lacks clearness and consistency. For example, consider the following sentence.

(18) Otoko no ko ga hako o tobikoeru mae ni onna no ko ga
boy of child box jump over girl

hako o tobikoeta
jumped over

Before the boy jumped over the box, the girl jumped over the box.

In an act-out task, it is expected that the girl jumps over the box, but the boy does not. As one adult Japanese native speaker puts it, sentence (18) describes the scene where the girl sneaks in front of the boy and jumps over the box ahead of him while the boy proceeds toward the box but to no avail. In sentence (18) the event in the embedded clause is never realized and, accordingly, is not acted out in an act-out task. Such interpretation of mae clauses is made when the event in both embedded and main clauses are the same, with different clausal subjects. This type of mae sentences may tend to occur in the familiar situations where children scramble for a toy or something coveted. The peculiar mae response tendency of acting out the event in the main

clause may be explained by assuming that children might overgeneralize such interpretation to other mae constructions where the event in the embedded clause is realized.

In contrast to the variability of meaning of the verb-ru form, the interpretation of the V-ta in the ato clause does not change even in this type of sentences. With regard to the other temporal clauses, the V-ta form in the toki clause expresses simultaneous as well as sequential relation. Children of 3 to 5 years learned the latter, but not the former yet. The temporal relation of the aida clause is rather defined by the verb form in the main clause. The V-te iru form in the main clause expresses the total inclusion within the state defined by the aida clause, in comparison to the undefined, partial inclusion denoted by a durative verb. As discussed in the experimental results of the previous section, even grade 5 and 6 children did not understand the temporal relation of the former, measured by using momentary verbs.

With the V-te iru in the embedded clause, the temporal relation observed in the embedded and main clauses in the aida sentences overlaps with that in the toki sentences.

(19) Watasi ga denwa de tomodachi to hanasite iru | toki / aida ni |
I telephone by friend with talking

shujin wa kaisha e dekaketa.
husband company to left

| When / While | I was talking with a friend over the phone, my husband left for office.[9]

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[9]It is reported that non-durative verbs tend to occur in when clauses in English, as follows (Makisita, 1980):

(a) Max was shining his shoes when Pete walked in.
(b) Pete walked in while Max was shining his shoes.

That being the case, the interchange of VPs in the main and embedded clauses results when this type of when sentence is translated into Japanese.

In toki sentences, the temporal relation between main and embedded clauses becomes far more complicated because of the fact that it changes not only with the contrast of V-ru and V-te iru but also depending upon the combination of the types of verbs in the main and embedded clauses. Accordingly, a full-fledged control of aida and toki is predicted to take a long time.

Slobin (1982) suggested that grammatical devices such as causation, negation and aspect may serve as local cues, facilitating sentence processing. He added, however, that aspect is not expected to serve as a local cue for young children of ages 4 and 5 in the acquisition of Turkish before/after sentences. It was proposed in the present study that the question of whether aspect functions as a local cue should be experimentally investigated.

The findings indicated that aspect could function as a local cue in the acquisition of Japanese temporal clauses when the following conditions meet: (1) it uniquely co-occurs with a particular connective and (2) it, combined with the connective, provides 'clear' and 'consistent' marking of temporal relation to the event in the main clause. Only the V-ta form in the ato clause meets these conditions. The V-ru form in the mae clause is utilized by the children as a local cue but incorrectly. The children have not fully mastered the use of mae sentences, thus not supporting Hypothesis 2.

Finally, Hypothesis 3 will be briefly evaluated. The Hypothesis is presented as follows:

> Hypothesis 3: Comprehension of temporal connectives is better in a natural, meaningful condition than in an experimental condition in which arbitrary sentences are used to test the temporal connectives.

The other experimental studies of temporal connectives expressing both a sequential and a simultaneous relation have all been conducted using arbitrary sentences and the results were different from those obtained in naturalistic observation studies. This difference may be due to the demand of experimental tasks in which children were required to manipulate toys in accordance with arbitrary sentences. It is felt that the acquisition of these terms should be investigated in a more natural, meaningful situation where the manipulation demand is kept to a minimum.

Recent investigations of memory have revealed that preschoolers have an ordered knowledge of their daily life and that they utilize this knowledge when the verbal or situational context calls for it (McCartney & Nelson, 1981), just like adults do when following a "script" (Schank and Abelson, 1977). In the present study, event series about the daily life of a young child as depicted in pictures were employed to provide a natural, meaningful condition (story task 1). In order to test Hypothesis 3, children's control of temporal connectives in this condition were compared to those in experimental conditions in which another story task and two act-out tasks were employed.

The second story task consisted of a series of events in which the order was not as logical nor as predictable as in the event series about daily life. For example, in one series the action of a child's raising hands preceded the action of the child jumping over a box, followed by the slapping of his knees. This task was intended to test Hypothesis 3 by presenting an arbitrary sentence of events, in contrast to story task 1 of the event series about daily life. Furthermore, the

sentences employed in story task 2 paralleled those in act-out task 1 in terms of event relations expressed by the main and embedded clauses, so that a comparison of performances could be made across tasks. The fourth task, act-out task 2, was semantically different from act-out task 1. While the clausal subject was one and the same for both main and embedded classes used in act-out task 1, in task 2 the clause had different subjects. This task was modeled after those found in English experimental studies such as Feagans (1980) in order to make the results obtained comparable to English ones.

The experimental results show that there was no significant difference between story tasks 1 and 2. Story task 2, however, differed significantly from act-out task 1 (Table 5.26), although there was also a significant interaction of task and sentence type. The performance on both act-out tasks was poor, and the performance on act-out task 2 was the worst.

Table 5.26

Analysis of Variance for Story Task 2 and Act-out Task 1

	SOURCE	ERROR TERM	SUM OF SQUARES	D.F.	MEAN SQUARE	F
1	MEAN	r(tas)	48480.048	1	48480.0476	7377.40
2	tasks	r(tas)	160.190	1	160.1905	24.38**
3	ages	r(tas)	761.810	2	380.9048	57.96**
4	sentence	r(tas)	1927.619	6	321.2698	48.89**
5	ta	r(tas)	20.667	2	10.3333	1.57
6	ts	r(tas)	482.810	6	80.4683	12.25**
7	as	r(tas)	70.024	12	5.8353	0.89
8	tas	r(tas)	118.833	12	9.9028	1.51
9	r(tas)		276.000	42	6.5714	

There were no meaningful event relations intended for the event series in story task 2, but the children did not have any difficulty finding the temporal relation between the events, probably because all the events represented a familiar, repeated experience of children. Thus, the results of story task 2 did not support the hypothesis. In contrast, the results of act-out tasks corroborated the hypothesis. They were different from the story tasks not only in terms of error rate but also in response patterns. Responses in accordance with the order-of-mention strategy outnumbered other types of responses. Although performances on _-nagara_ sentences which express a simultaneous relation, was best in the story tasks, it was not as good as the performance on _V-te, sorekara_ and _ato_ sentences. The results reflected those reported in the studies of Keller-Cohen (1975) and Feagans (1980). The act-out tasks, on the other hand, brought out a peculiar response pattern for _mae_ which would have otherwise been left unnoticed. The questions of why the children responded the way they did and when their responses approximate those of adults remain unanswered. Nussbaum and Naremore (1975) also found variation of responses across tasks in their study of the use of _have_, and suggested the need to explore more imaginative approaches to get access to the child's language. A recent study by Weist, Wysocka, Witkowska-Stadnik, Buezowska and Konieczna (1984) gives a case in point. In their study of the Polish verb tense/aspect, Weist et al. succeeded in eliciting appropriate responses of temporal deictic notions from young children which had been previously lacking, simply by providing the obligatory context for them. Thus it demonstrated the inadequacy of many previous experiments (see also Rispoli & Bloom, 1985).

In the present study, the story tasks generally seem to have succeeded in eliciting unbiased responses when compared with those of the act-out tasks, except for the responses of toki sentences. The choice of appropriate tasks and stimulus constructions always is a challenge for those who engage in the acquisition study of child language.

5.4 Summary

In summary, Hypothesis 1 was not supported by the results of the present experiments. It was speculated that factors other than conceptual notions may be in effect for the acquisition of temporal clauses.

Hypothesis 2, relating to the function of local cues, was supported by the results of ato clauses. The verb-ta form serves as a local cue in the acquisition of ato clauses, but not the verb-ru form in mae clauses.

Finally, the results of the present study demonstrated clear task differences. The story tasks generally seem to have succeeded in eliciting unbiased responses when compared with those of the act-out tasks, thus corroborating Hypothesis 3.

6. SUMMARY AND CONCLUSION

6.1 Summary

The present study was initiated as an attempt to clarify the long standing question of what the most relevant factors are which determine the acquisition or development of given linguistic forms, particularly those of temporal connectives.

The relation of cognitive development to language development has long been discussed in the developmental psycholinguistics literature. The acquisition of temporal connectives is assumed to be a good area of research to investigate such a relation because the acquisition of temporal notions is believed to be measurable independently from language by non-linguistic means. Research findings indicate the development of temporal notions in the order of sequence > simultaneity > sequential notions of before/after.

This order is well reflected in the acquisition of temporal connectives as reported in the developmental psycholinguistic literature (Clancy et al., 1976; Clark, 1970). Hypothesis 1 was formulated to test whether the developmental order of temporal notions can also predict the development of Japanese temporal connectives.

Hypothesis 2 was formulated in light of the results reported by Slobin (1982), who found that in comprehension tests Turkish children understood before/after sentences at a much younger age than English children. He explained these results in terms of 'local cues,' thus calling into question the cognitively and semantically based

explanations of the acquisition of these terms in English and French. The roles of local cues were investigated in the present study to provide further evidence to clarify the process of language acquisition from cross-linguistic data. In the present study, the local cue under consideration is grammatical aspect as expressed by the V-ru/-ta form in temporal clauses.

Investigations of this nature based on detailed longitudinal data of many very young children record the appearance of given forms, but they do not tell us whether the children fully grasp the proper use of these forms. Accordingly, an experimental method was adopted in the present study.

The results reported in past experimental studies of temporal connectives differed from those of naturalistic observation studies. The differences are likely due to factors associated with those tasks utilized in the experiments. In the present study, great care was taken to elicit unbiased responses. Hypothesis 3, accordingly, was formulated to test the assumption that the results in experimental tasks, such as act-out tasks, did not really reflect the true state of a child's language development.

The major findings of the four main tasks are that performance increases with age and ease of processing of sentence types is task-dependent. A consistent age effect was obtained in all the experiments conducted in the present study.

The present study adopted two kinds of comprehension tasks: a story comprehension and an act-out task. Each task had two sub-tasks. The results obtained were different across tasks in terms of percent

correct and response patterns. The act-out tasks were found to be more difficult than the story tasks.

The response patterns of the act-outs were also different from those of the story tasks. In act-out tasks the percent correct of sentences in which the order of events described corresponded to the order of occurrence was higher than those in which the event order did not match the order of occurrence. Consequently, while performance on a simultaneous connective, _-nagara_, was particularly good for even 3-year-olds, followed by _V-te, sorekara_ and _ato_, in both story tasks, different results were obtained in act-out task 1 (_-nagara_ sentences were not used in task 2). The high level of performance on _-nagara_ sentences in the story tasks did not support Hypothesis 1, which predicted the earlier development of sequential connectives over simultaneous ones. The rather good results of _ato_ in the story tasks which did not involve an act-out, on the other hand, may suggest the function of a local cue at work.

The second hypothesis, which predicted the earlier development of _mae/ato_ sentences over _toki/aida_ sentences, was examined. Although performance on _mae_ was good in story task 1, it was not as good as that on _ato_ in other tasks. In fact, there were very few correct performances on _mae_ in the act-out tasks, due to the peculiar response pattern in which the majority of children acted out the action in the main clause only. Thus, due to the poor results of _mae_, Hypothesis 2 was not supported.

This peculiar response pattern was found to persist through the age of 11 and 12. A possible explanation attributes this response

tendency to the children's overgeneralized use of an interpretation of a specific type of mae sentence to other constructions. The fact that a similar tendency was observed in the responses of V-ru toki sentences leads one to speculate that the children may be using the V-ru form as a local cue, though not correctly.

In contrast to mae sentences, performance on ato was good even in the story tasks. Four factors which may facilitate the acquisition of ato sentences were suggested: (1) they can be processed by an order-of-mention strategy, (2) they involve a unique marking of the use of ato in the temporal domain, (3) they involve a unique co-occurrence of V-ta and the connective ato and (4) they reflect a clear and consistent marking of the temporal relation to the event in the main clause, expressed by the V-ta form and ato.

The V-ta form expresses either the simple past or the completive aspect, and within the embedded clause this form expresses the event preceding that represented by the main clause. In the context where such an event relation holds, the V-ta form serves as a local cue, namely, in ato clauses and in relative clauses. In other contexts, such as in the toki clause of simultaneity, the V-ta form does not function as a local cue, and accordingly, its use is predicted to develop late.

The V-ru form signifies the following event relation to the event in the main clause. The V-ru form, however, sometimes expresses an unrealized action or event. As discussed in the previous chapter, the V-ru form in mae clauses expresses either one of these event relations depending on the construction. Apparently, the children have

learned the use of the latter construction and may overuse it on the former in the act-out tasks.

Finally, the present study demonstrated clear task differences. The story task generally seems to have succeeded in eliciting unbiased responses when compared with those of the act-out tasks, thus corroborating Hypothesis 3. The act-out tasks, on the other hand, brought out the peculiar response pattern for mae which would have otherwise been left unnoticed. The results of the present study once again remind us of the importance of employing various means to investigate child language development.

6.2 Suggestions for Further Research

In the present study Hypothesis 1 was not supported, and several possible reasons were suggested as to why the hypothesis was not borne out. First of all, the stimulus form, V-te, sorekara, was not a suitable form for testing the children's knowledge of sequential relation. The V-te form should be explored in future studies addressing this issue. Secondly, comprehension of temporal connectives should be compared with primitive devices of connecting sentences recorded in longitudinal data. There are data from a few children reported in the Japanese developmental psycholinguistic literature and, whenever possible, these data were examined closely. However, the relative timing of the first appearances of a given form sometimes varied across children. For example, the first appearances of -nagara in two children were found to be twelve months apart. More longitudinal data are needed in order to investigate the primitive use of connectives among children.

Hypothesis 2, regarding the function of local cues, was supported by the results of ato clauses, but not by the V-ru form in mae clauses. The children interpreted the V-ru form as expressing an unrealized event in the act-out tasks, thus producing the effect that mae sentences have the same interpretation as those of ... nai uchi ni. In the following type of before sentence quoted from Terakura (1985), the event in the main clause prevents the event in the before clause from occurring, i.e., the latter event is not realized.

(1) Tom ate the ice cream bar before it melted.

Tom wa aisu kuriimu ga { ?tokeru mae ni / tokenai uchi ni } tabeta

According to Terakura (1985), Japanese native speakers' reaction to a mae translation of this type of before sentences may vary from acceptable to awkward. When the before sentence expresses the causal relation as above, it is translated into ... nai uchi ni sentences rather than into mae sentences which would denote the temporal relation.

In the following type of sentence, however, mae clauses are considered ambivalent. The event in the mae clause is interpreted as being realized at one time and as unrealized at another time, probably one of a competing occasion.

(2) Otoko no ko ga hako o tobikoeru mae ni onna no ko ga hako o tobikoeta.

Before the boy jumped over the box, the girl jumped over the box.

When ... nai uchi ni is used instead, the event in the temporal clause will definitely denote an unrealized event. This type of mae sentence seems likely to be used often among children at kindergarten or among

siblings to express the unrealized event in mae clause. If that is the case, the other use of mae develops late. Furthermore, the use of ... nai uchi ni is predicted to develop late. The assumption should be examined in conversation data between children or between a caretaker and children.

The connective uchi ni was not included in the present investigation because of its subtle meaning differences from aida. There are other temporal connectives corresponding to until or since, but developmental studies of these Japanese temporal connectives have not been undertaken at all. The demarcation of the use of these temporal terms is complicated and sometimes subtle. Accordingly, their acquisitions sometimes is predicted to take a long time. Research attempts should be continued not only with preschool children but with much older children as subjects to clarify these aspects of language acquisition.

6.3 Conclusion

In summary, Hypothesis 1 was not supported by the results of the present experiment. It was speculated that factors other than conceptual notions may be operative in the acquisition of temporal clauses.

Hypothesis 2, dealing with the function of local cues, was supported by the results of ato clauses. The V-ta form serves as a local cue in the acquisition of ato clauses, but the V-ru form does not serve such a function in mae clauses.

The results of the present study demonstrated clear task differences. The story tasks generally seem to have succeeded in eliciting unbiased responses when compared with those of the act-out tasks. Thus, these results corroborated Hypothesis 3.

The results obtained from the data of the grade 5 and 6 children demonstrated that even these older children made the same type of mistakes on mae and V-ru toki as the younger children, i.e., they acted out the event in the main clause only. The adults all acted out the events in both clauses.

The duration scores obtained from grade 5 and 6 children and adults indicated that even grade 5 and 6 children, again like the younger children, did not see the difference between V-ta and V-te ita sentences of momentary verbs. Accordingly, in contrast to the adults, there was no difference found in the performances of these children between aida sentences which had V-ta and those which had V-te ita in the main clause, respectively.

Slobin (1982) suggested that grammatical devices such as causation, negation, and aspect may serve as local cues, facilitating sentence processing. However, he added that aspect is not expected to serve as a local cue for young children in the acquisition of Turkish before/after sentences. It was proposed in the present study that the question of whether aspect functions as a local cue should be experimentally investigated.

The findings indicated that aspect could function as a local cue in the acquisition of Japanese temporal clauses when certain conditions meet. Only the V-ta form in the ato clause was found to meet the conditions.

The results with grade 5 and 6 children have shown that the children still have problems with understanding an aspectual use of the V-te ita form of momentary verbs. Thus, aspect expressed by the V-te ita does not function as a local cue in the sentences. The aspect may facilitate the processing of other sentences as observed in the V-ta form in the ato sentences. Further studies are needed in order to determine under which conditions grammatical devices such as aspect act as local cues.

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APPENDIX A

1. Test Sentences Used in Story Task 1

Set A

1. Kono ko wa gohan o tabete, sorekara nani o simasu ka.
   This child has a meal, and then what does he do?

2. Kono ko wa gohan o tabe-nagara nani o simasu ka.
   What does this child do while having a meal?

3. Kono ko wa hoikuen e iku toki, nan to iimasu ka.
   What does this child say when he goes to day care?

4. Kono ko wa gohan o taberu mae ni, nani o simasu ka.
   What does this child do before he has a meal?

5. Kono ko wa gohan o tabete iru aida, nani o simasu ka.
   What does this child do while he is having a meal?

6. Kono ko wa gohan o tabeta ato, nani o simasu ka.
   What does this child do after he has a meal?

7. Kono ko wa hoikuen e itta toki, nan to iimasu ka.
   What does this child say when he has arrived at day care?

Set B

1. Kono ko wa oyatsu o tabete, sorekara nani o simasu ka.
   This child has a snack, and then what does he do?

2. Kono ko wa oyatsu o tabe-nagara nani o simasu ka.
   What does this child do while having a snack?

3. Kono ko wa hoikuen kara kaeru toki, nan to iimasu ka.
   What does this child say when he leaves day care?

4. Kono ko wa oyatsu o taberu mae ni, nani o simasu ka.
   What does this child do before he has a snack?

5. Kono ko wa oyatsu o tabete iru aida, nani o simasu ka.
   What does this child do while he is having a snack?

6. Kono ko wa oyatsu o tabeta ato, nani o simasu ka.
   What does this child do after he has a snack?

7. Kono ko wa hoikuen kara kaetta toki, nan to iimasu ka.
   What does this child say when he is back from day care?

Set C

1. Kono ko wa ofuro e haitte, sorekara nani o simasu ka.
   This child takes a bath, and then what does he do?

2. Kono ko wa ofuro e hairi-nagara nani o simasu ka.
   What does this child do while taking a bath?

3. Kono ko wa gohan o taberu toki, nan to iimasu ka.
   What does this child say when he has a meal?

4. Kono ko wa ofuro e hairu mae ni, nani o simasu ka.
   What does this child do before he takes a bath?

5. Kono ko wa ofuro e haitte iru aida, nani o simasu ka.
   What does this child do while he is taking a bath?

6. Kono ko wa ofuro e haitta ato, nani o simasu ka.
   What does this child do after he takes a bath?

7. Kono ko wa gohan o tabeta toki, nan to iimasu ka.
   What does this child say when he has had a meal?

2. Test Sentences Used in Story Task 2

Set A

1. Kono ko wa booru o kette, sorekara nani o simasu ka.
   This child kicks the ball, and then what does he do?

2. Kono ko wa booru o ketta ato nani o simasu ka.
   What does this child do after he kicks the ball?

3. Kono ko wa booru o keru mae ni, nani o simasu ka.
   What does this child do before he kicks the ball?

4. Kono ko wa booru o keru toki, nani o simasu ka.
   What does this child do when he kicks the ball?

5. Kono ko wa booru o ketta toki, nani o simasu ka.
   What does this child do when he has kicked the ball?

6. Kono ko wa kuruma o hippari-nagara nani o simasu ka.
   What does this child do while he is pulling the cart?

Set B

1. Kono ko wa hako o tobikoete, sorekara nani o simasu ka.
   This child jumps over the box, and then what does he do?

2. Kono ko wa hako o tobikoeta ato, nani o simasu ka.
   What does this child do after he jumps over the box?

3. Kono ko wa hako o tobikoeru mae ni, nani o simasu ka.
   What does this child do before he jumps over the box?

4. Kono ko wa hako o tobikoeru toki, nani o simasu ka.
   What does this child do when he jumps over the box?

5. Kono ko wa hako o tobikoeta toki, nani o simasu ka.
   What does this child do when he has jumped over the box?

6. Kono ko wa jitensha ni nori-nagara nani o simasu ka.
   What does this child do while riding the bicycle?

7. Kono ko wa jitensha ni notte iru aida, nani o simasu ka.
   What does this child do while he is riding the bicycle?

Set C

1. Kono ko wa omocha o katazukete, sorekara nani o simasu ka.
   This child tidies up the toys, and then what does she do?

2. Kono ko wa omocha o katazuketa ato, nani o simasu ka.
   What does this child do after she tidies up the toys?

3. Kono ko wa omocha o katazukeru mae ni, nani o simasu ka.
   What does this child do before she tidies up the toys?

4. Kono ko wa omocha o katazukeru toki, nani o simasu ka.
   What does this child do when she tidies up the toys?

5. Kono ko wa omocha o katazuketa toki, nani o simasu ka.
   What does this child do when she has titied up the toys?

6. Kono ko wa hon o yomi-nagara nani o simasu ka.
   What does this child do while reading a book?

7. Kono ko wa hon o yonde iru aida, nani o simasu ka.
   What does this child do while she is reading a book?

3. Test Sentences Used in Act-out Task 1

1. Usagi ga booru o kette, sorekara kuruma o osita.
   The rabbit kicked the ball, and then pushed the cart.

2. Usagi ga kuruma o osi-nagara, te o nameta.
   The rabbit licked his hand while pushing the cart.

3. Usagi ga booru o keru toki, te o ageta.
   When the rabbit kicked the ball, he raised his hand.

4. Usagi ga booru o ketta toki, sakadachi o sita.
   When the rabbit had kicked the ball, he stood on his head.

5. Usagi ga kuruma o osite iru aida, te o nameta.
   While the rabbit was pushing the cart, he licked his hand.

6. Usagi ga booru o ketta ato, kuruma o osita.
   After the rabbit kicked the ball, he pushed the cart.

7. Usagi ga booru o keru mae ni, te o tataita.
   Before the rabbit kicked the ball, he clapped his hands.

8. Usagi ga jitensha ni nori-nagara, te o futta.
   The rabbit waved his hand while riding the bicycle.

9. Usagi ga hako o tobikoeta ato, jitensha ni notta.
   After the rabbit jumped over the box, he rode the bicycle.

10. Usagi ga hako o tobikoeta toki, te o tataita.
    When the rabbit had jumped over the box, he clapped his hands.

11. Usagi ga hako o tobikoeru mae ni, te o futta.
    Before the rabbit jumped over the box, he waved his hand.

12. Usagi ga hako o tobikoeru toki, te o ageta.
    When the rabbit jumped over the box, he raised his hands.

13. Usagi ga hako o tobikoete, sorekara jitensha ni notta.
    The rabbit jumped over the box, and then rode the bicycle.

14. Usagi ga jitensha ni notte iru aida, te o futta.
    While the rabbit was riding the bicycle, he waved his hand.

4. Test Sentences Used in Act-out Task 2

1. Otoko no ko ga tora o tataita ato, onna no ko ga zoo o nameta.
   After the boy hit the tiger, the girl licked the elephant.

2. Otoko no ko ga torao tataita toki, onna no ko ga zoo o nameta.
   When the boy had hit the tiger, the girl licked the elephant.

3. Otoko no ko ga tora o tataite iru aida, onna no ko ga zoo o nameta.
   While the boy was hitting the tiger, the girl licked the elephant.

4. Otoko no ko ga tora o tataite, sorekara onna no ko ga zoo o nameta.
   The boy hit the tiger, and then the girl licked the elephant.

5. Otoko no ko ga tora o tataku mae ni, onna no ko ga zoo o nameta.
   Before the boy hit the tiger, the girl licked the elephant.

6. Otoko no ko ga tora o tataku toki, onna no ko ga zoo o nameta.
   When the boy hit the tiger, the girl licked the elephant.

7. Onna no ko ga uma o nadete, sorekara otoko no ko ga inu o tobikoeta.
   The girl stroked the horse, and then the boy jumped over the dog.

8. Onna no ko ga uma o naderu mae ni, otoko no ko ga inu o tobikoeta.
   Before the girl stroked the horse, the boy jumped over the dog.

9. Onna no ko ga uma o nadeta ato, otoko no ko ga inu o tobikoeta.
   After the girl stroked the horse, the boy jumped over the dog.

10. Onna no ko ga uma o nadete iru aida, otoko no ko ga inu o tobikoeta.
    While the girl was stroking the horse, the boy jumped over the dog.

11. Onna no ko ga uma o nadeta toki, otoko no ko ga imu o tobikoeta.
    When the girl had stroked the horse, the boy jumped over the dog.

12. Onna no ko ga uma o naderu toki, otoko no ko ga inu o tobikoeta.
    When the girl stroked the horse, the boy jumped over the dog.

13.* Otoko no ko ga tora o tataite iru aida, onna no ko ga zoo o namete ita.
    While the boy was hitting the tiger, the girl was licking the elephant.

14.* Onna no ko ga uma o nadete iru aida, otoko no ko ga inu o tobikoete ita.
While the girl was stroking the horse, the boy was jumping over the dog.

(*Sentences 13 and 14 were used in the pilot study, and in the experiment with grade 5 and 6 children and adults as subjects.)

5. Test Sentences Used in the Relative Clause Task

Set A

1. Hako o tobikoeta ko wa dono ko desu ka.
   Which child is the one who jumped over the box?

2. Suberidai o subetta ko wa dono ko desu ka.
   Which child is the one who slid down the slide?

3. Suberidai ni noboru ko wa dono ko desu ka.
   Which child is the one who climbs up the slide?

4. Aisu kuriimu o kau ko wa dono ko desu ka.
   Which child is the one who buys the ice cream?

5. Jitensha ni notta ko wa dono ko desu ka.
   Which child is the one who rode the bicycle?

6. Sunaba ni hairu ko wa dono ko desu ka.
   Which child is the one who goes into the sandbox?

Set B

1. Hako o tobikoeru ko wa dono ko desu ka.
   Which child is the one who jumps over the box?

2. Suberidai o suberu ko wa dono ko desu ka.
   Which child is the one who slides down the slide?

3. Suberidai ni nobotta ko wa dono ko desu ka.
   Which child is the one who climbed up the slide?

4. Aisu kuriimu o katta ko wa dono ko desu ka.
   Which child is the one who bought the ice cream?

5. Jitensha ni noru ko wa dono ko desu ka.
   Which child is the one who rides the bicycle?

6. Sunaba ni haitta ko wa dono ko desu ka.
   Which child is the one who went into the sandbox?

6. Test Sentences Used in the Duration Task

1. Onna no ko ga zoo o nameta.
   The girl licked the elephant.

2. Otoko no ga tora o tataita.
   The boy hit the tiger.

3. Onna no ko ga uma o nadeta.
   The girl stroked the horse.

4. Otoko no ko ga inu o tobikoeta.
   The boy jumped over the dog.

5. Onna no ko ga zoo o namete ita.
   The girl was licking the elephant.

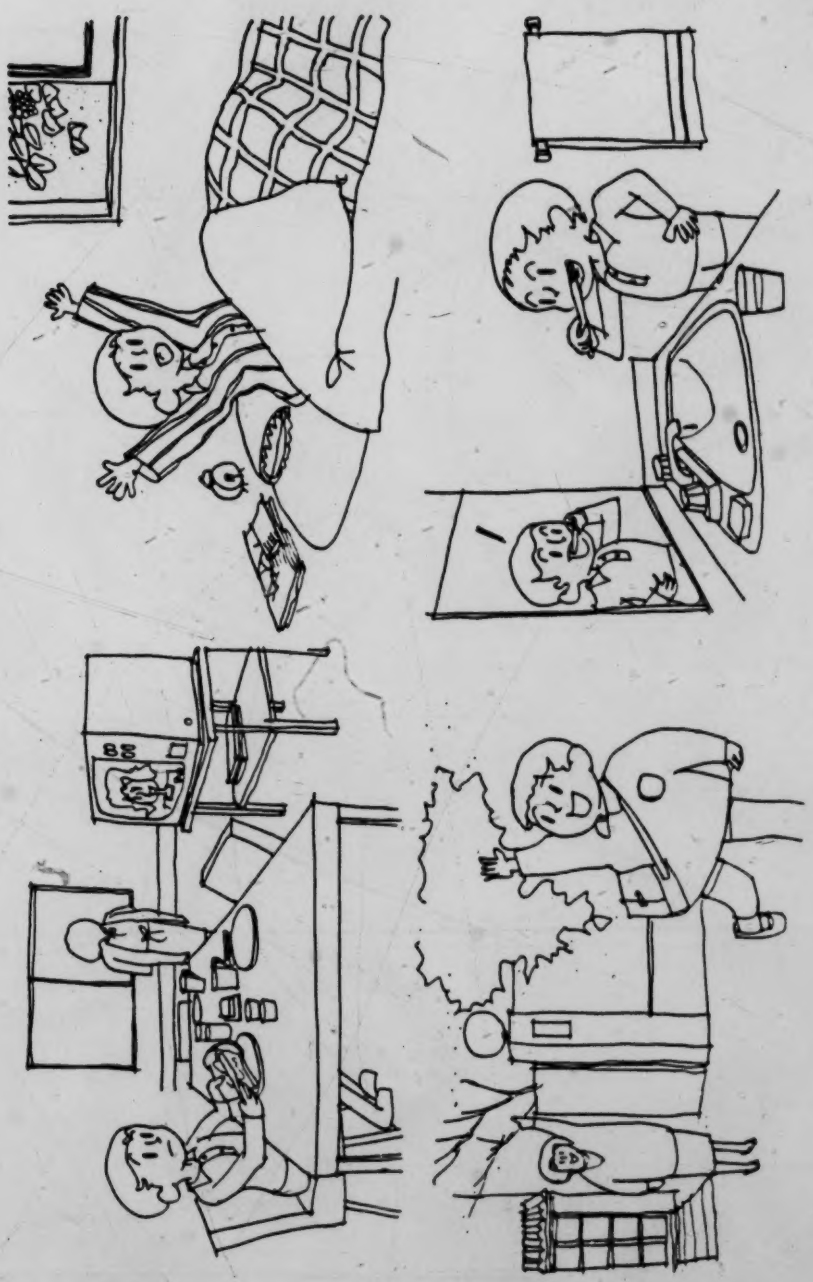
6. Otoko no ko ga tora o tataite ita.
   The boy was hitting the tiger.

7. Onna no ko ga uma o nadete ita.
   The girl was stroking the horse.

8. Otoko no ko ga inu o tobikoete ita.
   The boy was jumping over the dog.

APPENDIX B

1. Pictures Used in Story Task 1



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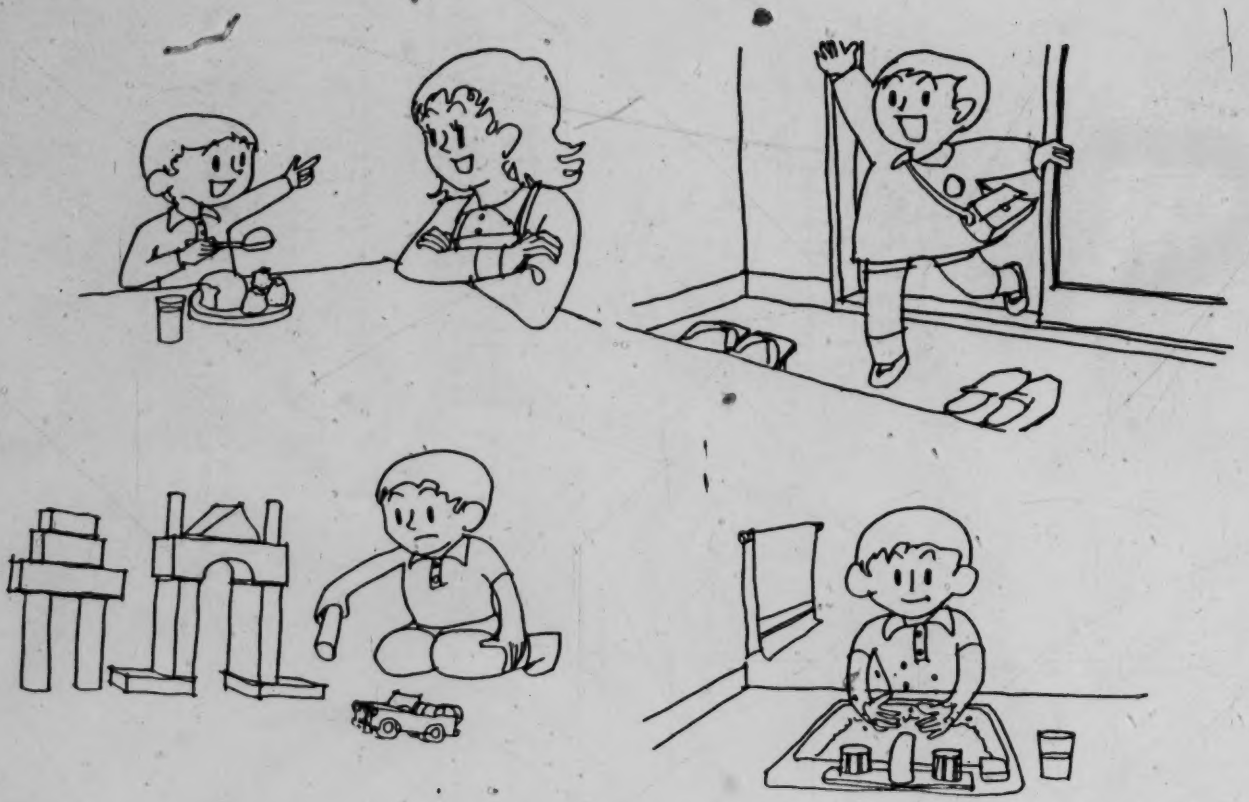

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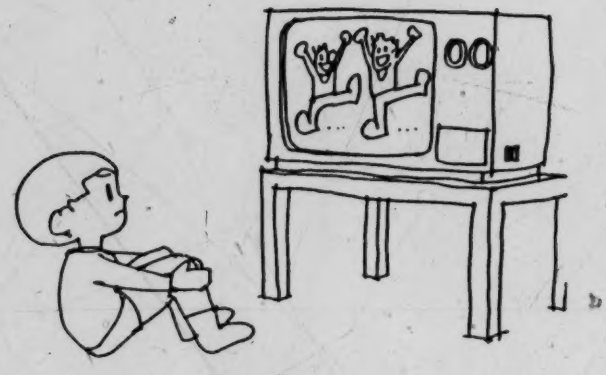

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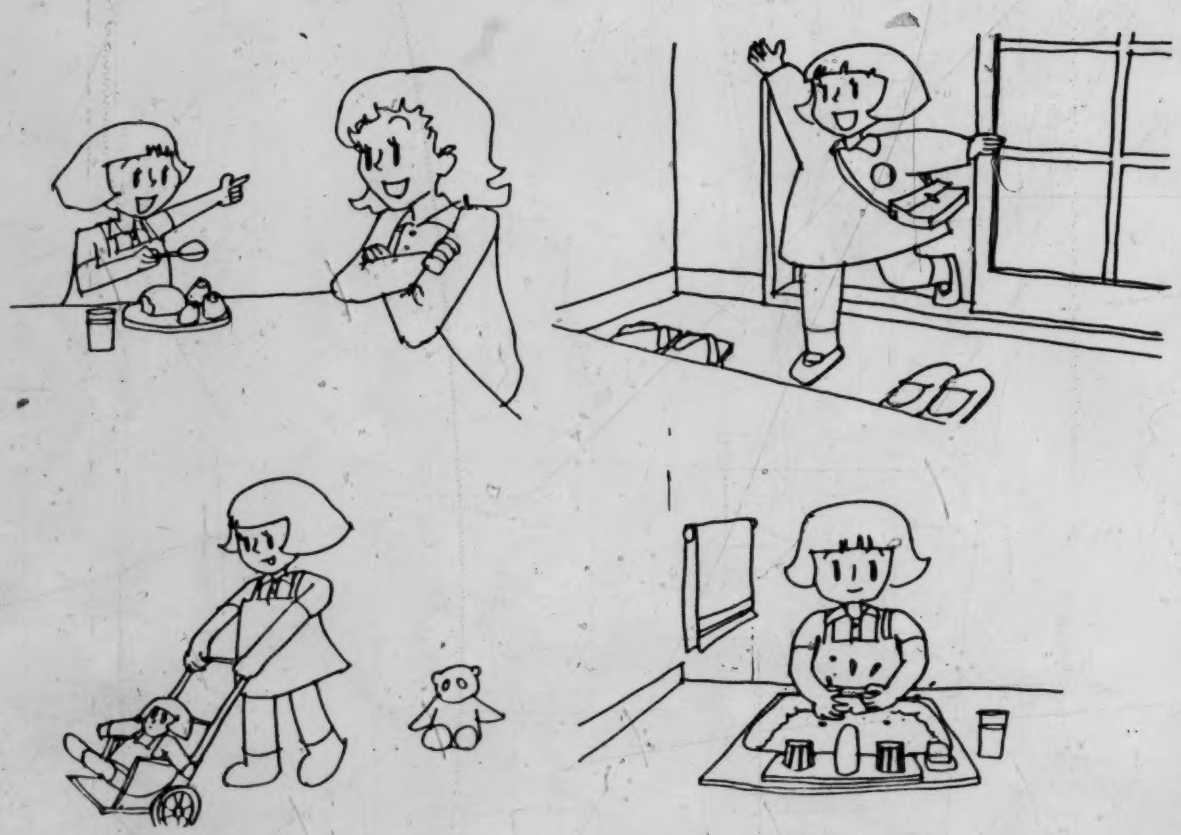

6. Pictures Used in Story Task 1

7. Pictures Used in Story Task 2

8. Pictures Used in Story Task 2

9. Pictures Used in Story Task 2